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Geographic Information — Gap-analysis: mapping and describing the differences between the current GDF and ISO/TC 211 conceptual models to suggest ways to harmonize and resolve conflicting issues

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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 211, *Geographic information/Geomatics*.

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

0.1 Background

From the start, GDF (Geographic Data Files) was based on similar geospatial concepts as ISO/TC 211 standards (the ISO 19100 family of standards). Over the years, GDF has been specified to provide data structures to support a range of transport-related applications and in-car navigation systems. GDF forms the basis of today's solutions used by TomTom, HERE and other navigational systems. The ISO 19100 family of standards created by ISO/TC211 remain the conceptual basis for general geospatial purposes. The basic concepts standards of the ISO 19100 family do not support any specific application domains but have been widely adopted by the geospatial industry; ISO/TC211 standards also underpin key European legislation such as the INSPIRE Directive.

With the emergence of increasingly connected and automated road vehicles, there is a need to share geospatial information between the vehicle's navigational and contextual awareness systems and the mapping and road authorities (the road-side actors). The exchange of map-data between these actors requires extensive interpretations and transformation rules to make sure that the map-data in the on-board car navigation systems is aligned with that of the road-side actors, and that exchanges of data robustly support safety and efficiency applications in an unambiguous, coherent way.

GDF continues to be developed to adapt to the requirements of road vehicle automation, as well as wider domains of application, such as public transport, geospatial and navigation data. A lack of alignment between GDF key concepts and those of ISO/TC211 standards reduces the collective efficacy of the combined standards, increases the complexity of utilizing standards-conformant data in an efficient manner and increases the risk and threats arising from ineffective conversions. This is not efficient, and is mostly due to the lack of harmonization between the conceptual models of GDF and ISO/TC 211 standards.

Both models are in extensive use: GDF in the vehicle in-car navigation industry and the ISO 19100 family of standards in the geospatial industry and with public authorities worldwide. Thus, it is not a non-disruptive option for one group of actors to switch to the other base of standards – nor indeed are these standards directly functionally equivalent. Therefore, the work underpinning this document aims to identify the gaps between the two concepts and suggest ways to bridge them.

First, there is a need to perform a gap analysis, and then after that, suggest means to bridge the gap and finally decide how to create standards or application schemas to accommodate the harmonization that is necessary. The identification of opportunities to adjust concepts to align GDF and ISO/TC 211 concepts supports the need to achieve an improved interoperability of road and vehicle data systems, and geospatial datasets in wider usage.

Within this document, comparative analysis and recommendations are provided. At a broad level, the analysis and recommendations suggest modifications to GDF to make an ISO 19100 family-based application schema in order to:

— make GDF ready to accommodate automated vehicles with support from ISO/TC 211;

— enable map data exchange between all actors (car makers, map makers, mapping authorities and road owners);

— align with ISO/TC 211-based standards and related technology used by European institutions, directives, CEN and in European-wide platforms like TN-ITS and DATEX II, and international stakeholder groups such as TISA.

During the development of this document, various iterations of the GDF have been used and reviewed. The current published version of GDF, known as GDF v5.1, Part 1, has been published as ISO 20524-1, published 2020-03-30, and ISO 20524-2, published 2020-11-30. These documents revise the previously used ISO 14825:2011, known as GDF v5.0. ISO 14825:2011 has been withdrawn. The analysis within this document uses GDF v5.1 (ISO 20524-1 and ISO 20524-2) as a reference baseline.

0.2 Overview of recommendations

0.2.1 General

This subclause brings together the recommendations that have been made throughout the body of this document. Each recommendation is summarized; in each case the reader is advised to review the relevant referenced clause for the full explanation. Also, in each case, the primary actor expected to address the recommendation is listed.

0.2.2 Model structure

See subclauses 7.1 and 7.2.1.

A more specific modularization of GDF according to the structure of the ISO 19100 family of standards is recommended to simplify maintenance, revision and reuse of the concepts in the document. Specified relations between the GDF Overall Conceptual Data Model and concepts from the ISO 19100 family of standards is recommended to improve interoperability and reduce the need for specific GDF concepts.

It is recommended that the generic feature model and the feature catalogue model in the GDF GDM be divided into specific models for a Generic Feature Exchange Model and a Feature Catalogue Model. The models are recommended to be defined as application schemas according to ISO 19109 and prepared for model-driven implementation.

There is a need for further studies on how to define the belt concept and the location referencing of GDF features in general in terms of ISO/TC 211 standards.

There is a need to achieve a greater clarity of linear referencing of belts.

To be addressed by ISO/TC 204 and ISO/TC 211.

0.2.3 General Conceptual Models

See subclause 7.2.

It is recommended that the internal GDF stereotypes “Feature”, “Attribute” and “Relationship” be replaced with the ISO 19109 stereotype “FeatureType”.

The core classes Feature and Attribute are recommended to be used only in the Generic Feature Exchange Model, while a specific superclass for feature classes is recommended to be used in the Feature, Attribute and Relationship Catalogues. The core Relationship class can be removed from the GDF GDM.

The conceptual models for attribute types and attribute values are recommended to be defined as metamodels to achieve an improved structure with a specified level of abstraction for concepts in the GDF model. The metamodels ought to extend the ISO 19109 GFM in order to achieve improved interoperability with models in, or based on, the ISO 19100 family.

It is recommended that the definition of a Feature in GDF be modified to include real-world phenomena that are not physical. Furthermore, it is recommended that classes for logical placement be evaluated and possibly changed to location referencing classes.

The album and dataset model are recommended to be defined in an application schema according to rules in ISO 19109. The model ought to include the data organization structure and the generic feature exchange model. To be addressed by ISO/TC 204.

0.2.4 The GDF Catalogues

See Clause 8.

It is recommended that the GDF Feature, Attribute and Relationship Catalogues be modelled as application schemas according to rules in ISO 19109. The GDF Metadata Catalogue is recommended to be modelled as a part of the model for album and dataset, with reuse of elements defined in ISO 19115-1.

It is recommended that a core superclass to replace the use of the classes Feature, Attribute and Relationship in the Feature, Attribute and Relationship Catalogues be defined.

The listing of unique IDs in ISO 20524-1:2020, A.1, A.2 and A.3 ought to be a report from the UML model, in order to maintain consistency. To be addressed by ISO/TC 204.

0.2.5 Encoding rules

It is recommended that GML implementation schemas for GDF be derived from the GDF application schemas. In order to enable handling of requirements for attribute content in GML, it is recommended that ISO/TC 211 seek to revise or amend ISO 19109 and ISO 19136-1 to facilitate such requirements.

If the two existing implementation encodings (MRS and GDF-XML) are to be maintained, specified conversion rules ought to be defined in order to enable conversions from the UML model. To be addressed by ISO/TC 204 and ISO/TC 211.

0.2.6 Aligning terminology

Annex A illustrates a continued difference between the definition of defined terms found in the GDF standards (ISO 20524-1 and ISO 20524-2) or ISO/TC 204 and definitions found in the ISO 19100 family of standards from ISO/TC 211. It is recommended that ISO/TC 211 lead activities to seek improved harmonization of defined terms and their definitions across the TCs. To be addressed by ISO/TC 204 and ISO/TC 211.

0.2.7 Aligning GDF time domain syntax with other ISO standards

It is recommended that a detailed analysis of the syntax characteristics supported by GDF and a comparison to the characteristics offered by the ISO 8601 series and ISO 19108 be undertaken in advance of preparation of future revisions of GDF (ISO 20524 series), with the aim of adopting ISO 8601 series and ISO 19108 conformant syntax mechanisms. To be addressed by ISO/TC 204 and ISO/TC 211.

0.2.8 Adding epoch value to dynamic coordinate reference system in GDF

Concern has been raised that GDF needs to differentiate between the use of 'static' and 'dynamic' coordinate reference systems, and add the epoch value in referencing to 'dynamic' CRS. To be addressed by ISO/TC 204.

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1 Scope

This document maps and describes the differences between GDF (ISO 20524 series), from ISO/TC 204, and conceptual models from the ISO 19100 family, from ISO/TC 211, and suggests ways to harmonize and resolve issues of conflict.

Throughout this document, reference to GDF refers to GDF v5.1, ISO 20524-1 and ISO 20524-2, unless expressly identified otherwise. Where necessary, reference will be made to Part 1 or Part 2.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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 https://www.electropedia.org/

NOTE Geospatial terms occurring in ISO/TC 211 standards can also be found in https://isotc211.geolexica.org/[21].

4 Symbols and abbreviated terms

The following abbreviated terms apply:

ADAS	advanced driver assistance systems
CRS	coordinate reference system
GDF GDM	geographic data files general data model
GDF	geographic data files
GFM	general feature model
GIS	geographic information system
GML	geography markup language
HD	high definition
ITS	intelligent transport systems