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Geografisk information – Typoberoende representation av geografiska företeelser

Geographic information – Generic representation of geographic phenomena

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Foreword

SS 63 70 06 Geographic information – Generic representation of geographic features was composed by the technical committee SIS/TK 323 Framework for geographic information. TK 323 is part of the project area Stanli within SIS, Swedish Standards Institute.

0 Introduction

0.1 Background

The modelling method that has been practiced within Swedish standardisation for geographic information implies that different types of phenomena belonging to a defined field of application are modelled explicitly for that field of application. Examples of such phenomena are *tunnel, bridge, protection area* and *easement*. Phenomena with similar characteristics are classified as feature types which are named, assigned attribute types and are given relations to each other through association types. In this way a concept model is created which will become a basis for the application schema. Application schemas are created specifically for respective field of application and contain definitions of the field's specific phenomena. When the schemas are implemented and used in different applications, unique instances (features in the form of data) are created from the defined feature types. Each single feature in a dataset being used by an application is therefore of a feature type specially defined and structured for this field of application. This is called *type dependent representation.*

EXAMPLE The term *bridge* represents a specifically defined feature type in some application schema. *The Øresund Bridge* may then be a uniquely identified instance of the feature type *bridge*. *Öland Bridge* and *Golden Gate Bridge* may then represent other, uniquely named, instances of the same feature type as the *Øresund Bridge*, i.e. the feature type bridge.

One problem with the specifically oriented application schemas is the risk that they relatively soon will become out of date. When a new feature type is required or when an existing feature type needs modification with e.g. a new attribute, the standardised application schema must be remodelled and published in a new version. Depending on the system design, eventual modification of existing software may be relatively extensive when a standard is revised.

NOTE See also annex A - Starting points, considerations and standpoints.

0.2 Type independent feature model

One way of avoiding the above mentioned problem is to develop and instead use a *generic – type independent feature model.* In a type independent feature model, no phenomena of any specific kind is expressly modelled. This technique makes it possible to construct a model and to develop application software without, at the time of modelling and development, knowledge about all feature types that may be managed by the application software when utilised.

A type independent feature model is therefore not able to specify data further than to say that a dataset contains features. The dataset contains a *type independent representation*. On the data level, the features are not distinguishable with respect to feature type.

0.3 Model for feature type catalogue

The type independent feature model is thus not sufficient for interpretation of data. In order to understand the information and to be able to manage features of different types in different ways, it is dependant on a feature type catalogue – a list containing every feature type that the application shall be able to manage. When the catalogue is accessible, every feature is able to refer to the feature type in the catalogue that constitute its type definition

EXAMPLE A dataset based on a type independent feature model contains three features. On the data level, the features are indistinguishable. They are called feature *1*, *2* and *3*. The three features have each a character string attached. The three character strings are respectively *Öland Bridge*, *Golden Gate Bridge* and *Tingstad Tunnel*. In addition, every feature has an associated integer. These are respectively the integers 40, 70 and 7. Without the help of a catalogue, these data are not interpretable. A catalogue is accessible containing two feature types called *bridge* and *tunnel*. Furthermore, the catalogue tells that both types have the characteristic *vertical clearance*. The catalogue says that the characteristic shall be reported as an integer with the unit *metre*. Features 1 and 2 points to the catalogue and the feature type *bridge* and feature 3 points to the same catalogue and the feature type *tunnel*. Through the definitions in the identified catalogue, data in the dataset obtain a meaning.

It is evident from the example above that features in datasets and the contents of feature type catalogues have a defined relationship to each other. Features in datasets are structured in conformance with a type independent feature model. The content of the feature type catalogue is structured in conformance with the catalogue model. As the type independent feature model and the catalogue model, from a structural and concept related viewpoint, reflect each other, what the feature represents may be construed from the catalogue. See also the figure below.

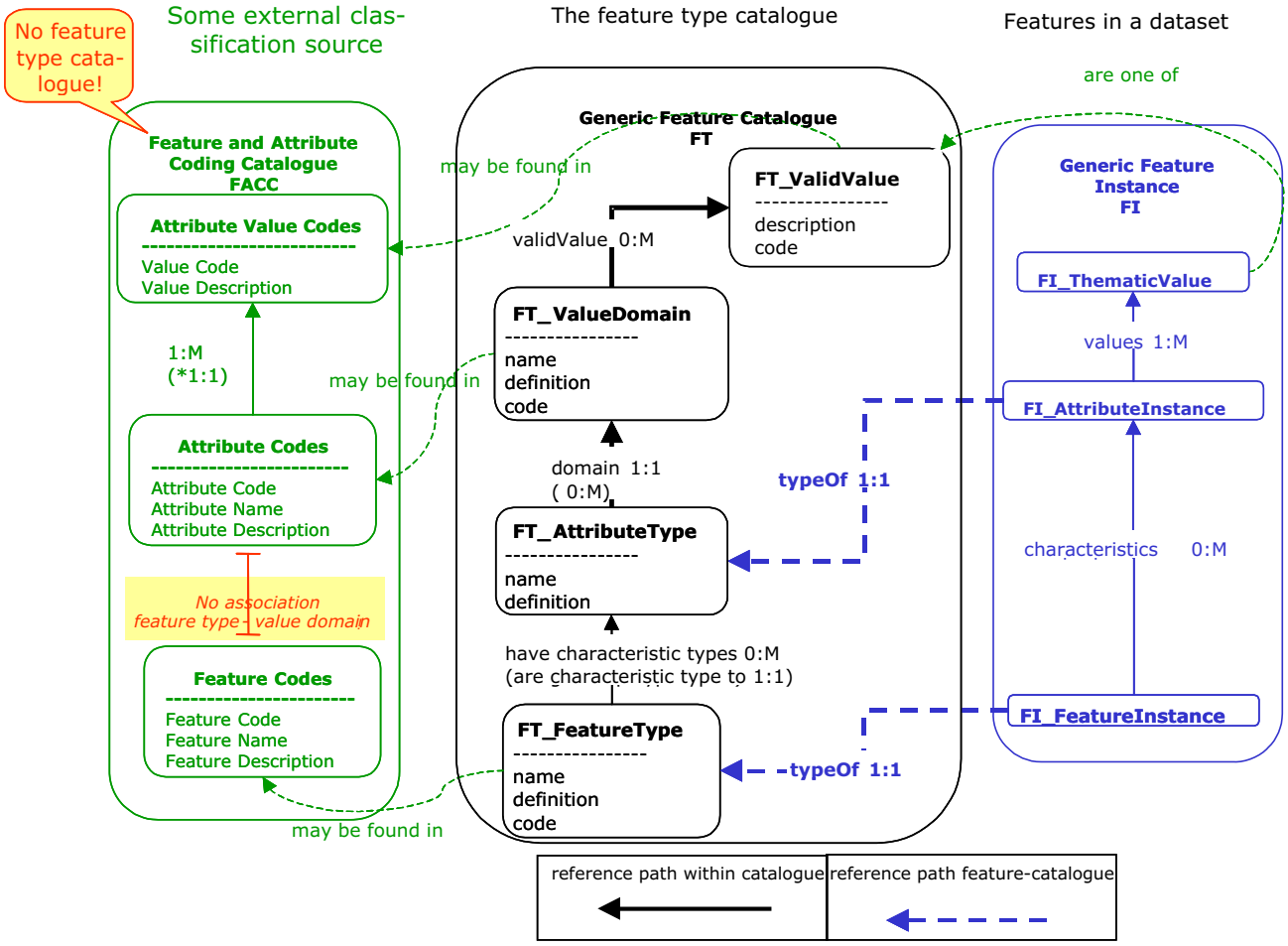

Figure 1 – Illustration of the principles for type independent representation

The figure above also shows that the feature type catalogue is able to use names, codes and definitions from some external classification source. Examples on such are FACC (Feature and Attribute Coding Catalogue, DGIWG) and KF85 (Map Database, The Swedish Association of Local Authorities).

There are two type types of classification sources, those that are pure reference books and those that constitute feature type catalogues (data dictionaries) in conformance with this standard. The latter have also a specifying role and are included as component in executing programs.

0.4 Use of this standard

The type independent feature model may be used independently to represent geographic phenomena, but may also be used together with some specially modelled, type dependent application schema. The type independent feature model, the catalogue model and the application schema are then together defining a complete feature representation for a field of application.

Through the use of a type independent feature model and feature type catalogues, the possibility is given for simplified addition and modification of the definitions of feature types. When the application demands a specific and time stable feature representation, a specific application schema should be defined. When frequent changes in the collection of feature types are expected and permitted, a type independent representation may be advantageous to use. The data exchange may then be made less sensitive to changes.

Applications based on a type independent feature model will for larger parts be data driven. Simpler applications, only intended to present data, do not need reconstruction as new feature types are introduced. All feature types are managed in the same way and when a new feature type is encountered, a search in the feature type catalogue is, when needed, performed to find specific information about the new feature type. There is also nothing preventing applications built on a type dependent feature model to deliver their data in conformance with the type independent model or vice versa.

0.5 The relationship between this standard and ISO 19110 Methodology for feature cataloguing

The feature type catalogue in this standard may superficially be regarded as competitor to ISO 19110. Looking at their aims and use, it is not.

ISO 19110 supplies a structure for the documentation of the semantic meaning of the classes, attributes, associations etc. that are part of an application schema. The application schema itself contains of course no semantic information.

This standard contains a type independent application schema. The definition of the feature types is done in the feature type catalogue. It defines in detail the construction of the different types as well as their semantic meaning. The definition structure for the construction of the types in detail is founded on *General Feature Model* (GFM) in ISO 19109 and the definition structure for the semantic meaning of the types is founded on *Feature Catalogue* (FC) in ISO 19110. This is the cause for the likeness between the feature type catalogue of this standard and GFM and FC. In the latter respect – but only in this – this standard is overlapping ISO 19110.

The case is simply that the ISO 19110 catalogue structure is inadequate for the aim of this standard. The feature type catalogue in this standard is specifying in the smallest detail of the value domain which is necessary when a data driven application executes and processes data. ISO 19110 does explicitly state that it doesn't embrace this. ISO 19110 is solely defining. The aim is to be available for development of application schemas.

0.6 Early respectively late binding

When part of an application is developed, and a type independent feature model forms the basis for the development, it can not, at the time of development, be adapted to manage specific feature types. It is only when the application is executed and provided with data that it recognizes which feature types to manage. This procedure is called *late binding*. If, on the other hand, the application schema that must contain every permitted feature type forms the basis for the development of an application, it is possible during development to create an application for the handling of just these feature types. This is called *early binding*.

The advantage with late binding is, as has been said above, greater flexibility and less sensitivity for changes. A price that may have to be paid for this flexibility is the risk for slower applications. Another disadvantage may arise if the catalogue model severely limits the possibilities for modelling in comparison with existing modelling languages (e.g. the modelling possibilities in UML and ISO/TC 19103 or EXPRESS).

Finally, for each use of this standard, it must be decided what role and status the feature type catalogue has. If the catalogue is to be regarded as a standard, part of the problems remains, namely the procedure regarding revision of standard.

1 Scope

The aim of this standard is to define an interface for the exchange of geographic information where exact knowledge about what feature types will be managed is unnecessary at the time of development of an interface. Secondary, it may form the basis for the definition of storage structures and for the development of applications, especially export and import routines.

This standard defines a *type independent feature model* and a *catalogue model* for feature type catalogues. The two models may together be used for type independent representation and data exchange within arbitrary fields of application.

This standard contains:

— application schema for the representation of contents in feature type catalogues

— application schema for type independent representation of geographic features

For a geographic dataset utilising this standard may:

— the permitted content of the dataset, including type of spatial representation, be specified in the feature type catalogue

— the meaning of data be interpreted

NOTE ISO 19110 only supports catalogue contents with the latter purpose.

The schemas of this standard support

— classification and definition of feature types

— classification and definition of characteristics of feature types

— definition of value domains, including references to standardised value domains in the ISO 19100 series (representation of geometry, topology, temporal aspects, quality and other metadata etc.)

— classification and definition of associations between feature types, among them aggregates

— generalisation/specialisation of feature types

— digital representation of phenomena, characteristics and associations

— grouping of feature types and value domains within a catalogue

— period of validity for definitions in the feature type catalogue

— management of different versions of features over time

The schemas do not support:

— operations for feature types

— derived or redefined attributes

— multiple inheritance

— specialisation of feature types

— overlapping specialisation (compare with ANDOR in EXPRESS)

— indirect spatial references in relation to infrastructure networks

— change management

Nor does this standard encompass administration and rules for the publication of catalogues and catalogue versions or catalogue content. This standard does not define any special transfer syntax.

NOTE Phenomena may be spatially stated. The geographic feature has normally a geometric or topologic representation. This is contained in the standard within value domains for attributes. I some cases, most generally within infrastructure networks, geometry and topology may be supplemented or substituted by an indirect position in relation to other features. This standard does not encompass such indirect spatial references. It is presumed that such are handled by the applications and standards there they are needed.

The extent of this standard is illustrated in the figure below.

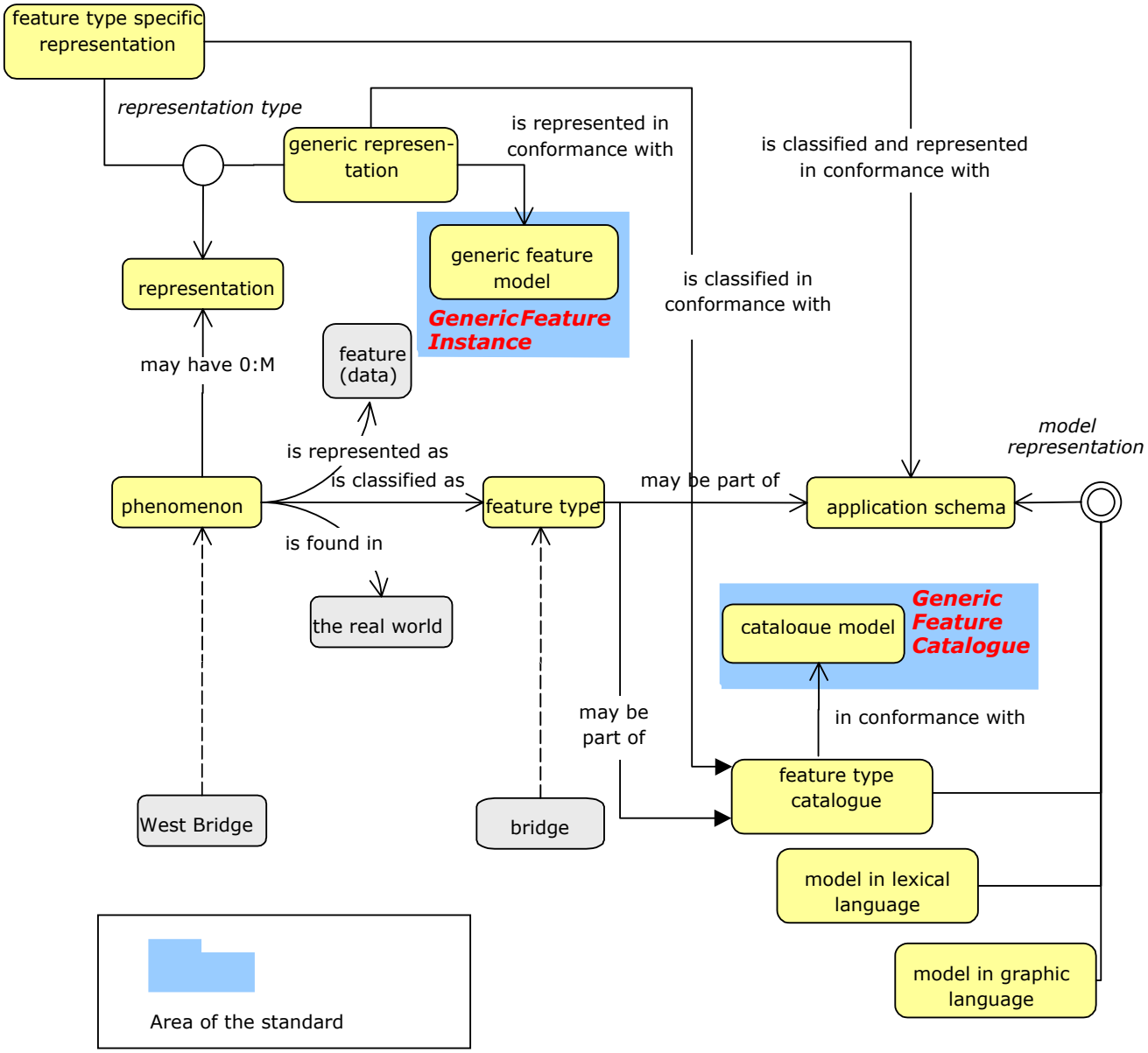

Figure 2 – Illustration of the model's extent and limitations

2 Normative references

The following reference documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

SS 63 70 07	*Geographic information – Representation of changes in datasets*
SIS-ISO/TS 19103:2006	*Geographic information – Conceptual schema language*
SS-EN ISO 19107	*Geographic information – Spatial schema*
SS-EN ISO 19108	*Geographic information – Temporal schema*
ISO 19109	*Geographic information – Rules for application schema*
SS-EN ISO 19112	*Geographic information – Spatial referencing by geographic identifiers*
SS-EN ISO 19115	*Geographic information – Metadata*
SS-ISO/IEC 19501:2005	*Information technology – Open Distributed Processing – Unified Modeling Language (UML) –Version 1.4.2*

NOTE 1 This standard is based on ISO 19110 for identification and description of feature type catalogues. Furthermore, the value domains of the attribute types, that define the attributes representation, have in the model been separated from the attribute type, that defines the meaning of an attribute. This makes it possible to use the same value domain in the catalogue for several attribute types for the same or different feature types.

Besides this, the possibility to assign feature types and value domains to categories (themes, sections etc.), has been incorporated for the objective of increasing the lucidity and facilitate the management of the content of a feature type catalogue.

NOTE 2 This standard is based on ISO 19109 for the definition of feature types. Furthermore, demands from Swedish participants has resulted in additions of definitions for e.g. periods of validity and structured value domains for attributes.

NOTE 3 This standard implies use of ISO 19118 for XML-representation, e.g. for identification and reference from features to the feature type catalogue. The feature model defined in ISO 19118 has been judged insufficient e.g. with regard to the demand for management of different time versions of one and the same phenomenon.

3 Terms and definitions

For the purpose of this document, the following terms and definitions are applicable. Some of the concepts are illustrated in figure 3.

3.1
abstract
class of which there can be no instances

3.2
aggregation
association with the meaning: that consists of [UML]

3.3
application schema
formal description of data structure, rules and content for information within a certain application area [Handbok för samverkande GIS]

NOTE 1 Application schemas shall be documented in UML as package and class diagrams.

NOTE 2 Application schema was earlier called application model

3.4
inheritance
specialisation where the subclass inherits the characteristics ot the superclass [UML]

3.5
association
relations between classes

3.6
attribute
characteristics of a class

NOTE Attributes are always of a certain attribute type.

3.7
attribute type
type of characteristic or description for a feature type [Stanli notation]

3.8
multiplicity
restriction regarding the number of instances of an attribute of a feature or an association of the same type

NOTE Is declared with minimum and maximum of permitted number

3.9
conceptual model
model explaining concepts and showing their mutual relations [Handbok för samverkande GIS]

3.10
conceptual schema
graphic representation of a concept model

NOTE In this standard, Stanli notation is used for conceptual schemas.

3.11
property type
attribute type or association type

3.12
phenomenon
something concrete or abstract that exists, has existed or will exist

EXAMPLE a person, an order, a car, a real estate, a judgement or a project

3.13
universe of discourse
view of the real or hypothetical world that includes everything of interest

3.14
catalogue model
model for the representation of the content in a feature type catalogue

3.15
catalogue entry
feature type, value domain or category that is part of a feature type catalogue

3.16
category
group of catalogue entries that has a name