Results of Development and Application of Geographic Information Standard in Vietnam

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Key words: Standard, GIS, database, map, Vietnam.

SUMMARY

Geographic information system has been applied in Vietnam since the 1990's of XX century in following areas: survey and mapping, cadastre, resources exploit planning, agriculture, forest, fishing, military, urban management, nature disaster supervision. But this process is spontaneous and do not follow any unified standard. In 2006, the Ministry of Natural Resources and Environment (MONRE) started The National Basic Geographic Information Standard and Basic Geographic data Standard development Program.

This paper reviews the process of development and application of The National Basic Geographic Information Standard and The Technical Rules for establishing basic geographic database. The National Basic Geographic Information Standard was issued in 2007 and 2008 by MONRE. This Standard is applied uniformly to build the basic geographic database and the other environmental and natural resources information system. The National Basic Geographic Information Standard was developed in accordance with ISO/TC211 and includes the following: Model of data structures, Model of spatial concept, Model of time concept, Geographic feature catalog, Coordinate reference system, Assessment of data quality, Metadata, Portrayal rule, Encoding and exchange data.

The Technical Rules for establishing basic geographic database includes: Coordinate reference system, Feature catalog, Application scheme, Data quality, Portrayal, Metadata, Data supplement and distribution.

The National Basic Geographic Information Standard and Technical Rules are being used to establish basic geographic data 1:2000 and 1:5000 for urban areas and 1:10000 for the whole country.

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1. BACKGROUND OF THE GIS APLICATION IN VIETNAM

GIS has been used in Vietnam since 90 years of the 20th century for resource management, agriculture, forestry, land survey, transportation etc… GIS technologies use digital information, for which various digitized data creation methods are used. The most common method of data creation is digitization, where a hard copy map or survey plan is transferred into a digital medium through the use of a CAD program, and geo-referencing capabilities. Geographic information can be accessed, transferred, transformed, overlaid, processed and displayed using numerous software applications such as: Intergraph, Autodesk, MapInfo and some other software made by Vietnam's software companies. Vietnam's GIS database is small and not comprehensive. It is wasteful and costly to use that above-mentioned software, because they cannot create a geographic database for common uses.

Since 2000, the ESRI's technology has been widely used. Standards for GIS database were set up; however, these standard GIS databases were used in stand-alone software and cannot be used in different software. This leads to the fact that various GIS databases cannot be connected to share information.

In 2000 the Vietnam Prime Minister issued the national reference system and coordinate system VN-2000.

Until 2000 the Ministry of Natural Resources and Environment (MONRE) has issued technical standards for the digital maps below:

- Technical regulations for making topographic maps at the scale of 1:10000, 1:25000 and 1:50000 with digital image technology.
- Technical regulations for making topographic maps at the scale of 1:250000, 1:500000 and 1:1000000.
- Technical regulations for making seabed maps at the scale of 1:50000.
- Technical regulations for establishing cadastral maps and land use maps.

These regulations are only for the digital maps, not for the national geographic information.

According to technical standards on here, in Vietnam has established the following types of map and database:

- Coordinate and elevation database.
- Digital topographic maps covering the whole country at the scales of 1:1000000, 1:500000, 1:250000, 1:100000 and 1:50000.
- Digital topographic maps at the scale of 1:25000 covering some mountainous and midland areas. There are also some topographic maps at the scales of 1:5000 and

1:2000 covering some major city such as Hanoi, Hochiminh City, Hue, Danang and Cantho.
- Cadastral maps are made locally. Cadastral maps for urban areas have been made at the scales of 1:200, 1:500 and 1:1000. Cadastral maps for rural areas were made at the scales of 1:500 and 1:1000. Cadastral maps made for agriculture lands are at the scales of 1:1000, 1:2000, for forestry areas at the scales of 1:10000 (using aero photos along with survey method).

Note that these types of maps and databases are in compliance with new digital regulations, but not by ISO-TC211.

In 2006 the Ministry of Natural Resources and Environment has adopted the plan for building geographic information standard including 3 stages as follows:
- Stage I (2006 – 2009): Building national basic geographic information standards and standards for basic geographic data and issued as technical regulations.
- Stage II (2010 – 2011): Improving the technical regulations and promulgated as a technical standards.
- Stage III (2012 - …): Publishing the national standards.

Results of standardization in stage 1 as following:
- Early 2007, the Ministry of Natural Resources and Environment has issued the decision to apply the geographic information basic standard.
- 2009 will complete the technical regulations following: Technical regulations for basic geographic data 1:2000, 1:5000; Technical regulations for basic geographic data 1:10000; Technical regulations for basic geographic data 1:50000 and Technical regulations for basic geographic 1:1000000;

The following is the introduction of the contents of the above standards.

2. THE GEOGRAPHIC INFORMATION BASIC STANDARD (GIBS)

2.1 Overview

The geographic information basic standard (GIBS) is based on ISO 19100 and the regulations of ISO 19106 – Profiles. GIBS is built in accordance with following ISO 19100 standards:
- ISO/TS 19103 Geographic Information - Conceptual Schema Language
- ISO/DIS 19107 Geographic Information - Spatial schema
- ISO/DIS 19108 Geographic Information - Temporal schema
- ISO/DIS 19109 Geographic Information - Rules for Application Schema
- ISO/FDIS 19110 Geographic Information - Methodology for Feature Cataloguing
- ISO/FDIS 19113 Geographic Information - Quality principles
- ISO 19114 Geographic Information - Quality evaluation procedures
- ISO 19115 Geographic Information - Metadata
- ISO 19117 Geographic Information - Portrayal
- ISO 19111 Geographic Information - Spatial Referencing by Coordinates
- ISO 19101 Geographic Information - Encoding

- ISO 19136 Geographic Information - Geography Mark-up Language

GIBS include the following 9 standard:

- Standards for geographic data structure
- Standards for spatial concept module
- Standards for time concept module
- Standards for classifications of geographic object
- Standards for spatial referencing by coordinate
- Standards for assessment of geographic data quality
- Standards for metadata
- Standards for presenting geographic data
- Standards for encoding, data sharing's.

Basically these standards are based on the principles of standards in the corresponding series ISO 19100. Therefore, below only introduce more structure model of geographic data and classifications of geographic objects.

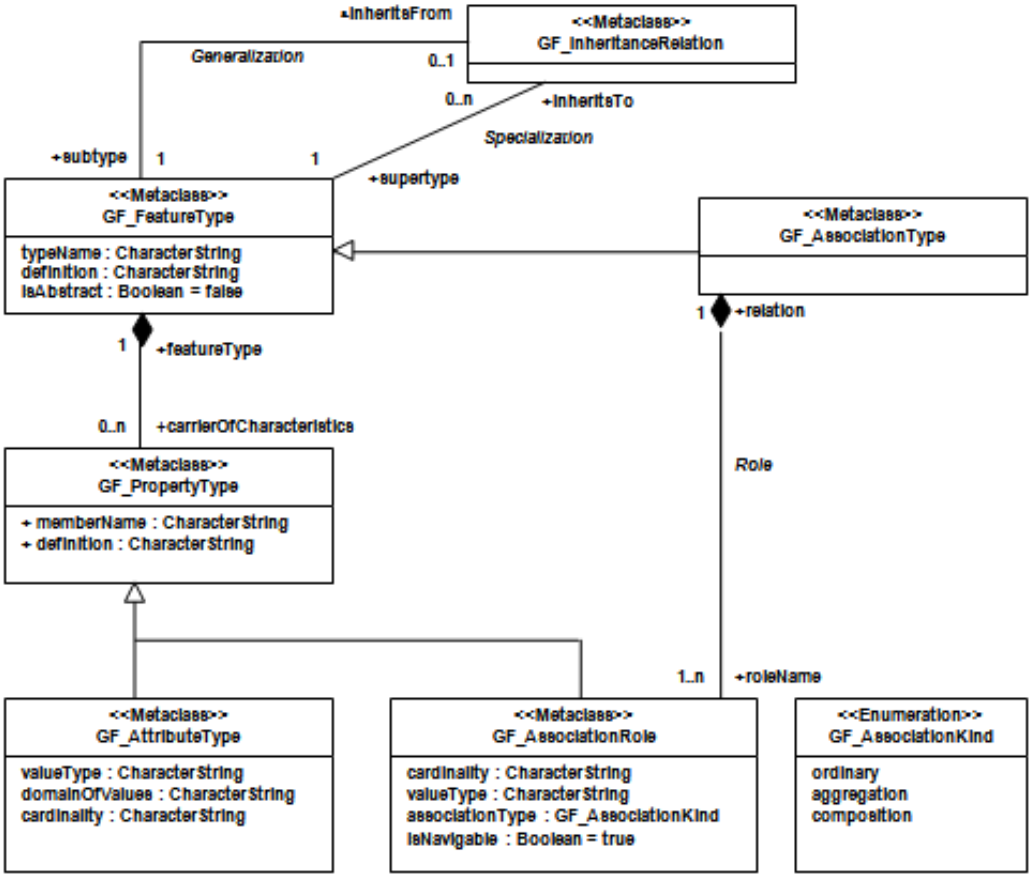
2.2 Standard for structure model of geographic data

Unified Modeling Language (UML) is applied to perform the conceptual scheme and general structure scheme of geographic data (application scheme) to define the geographic information. UML is used in defining structure model of geographic data includes the following components:

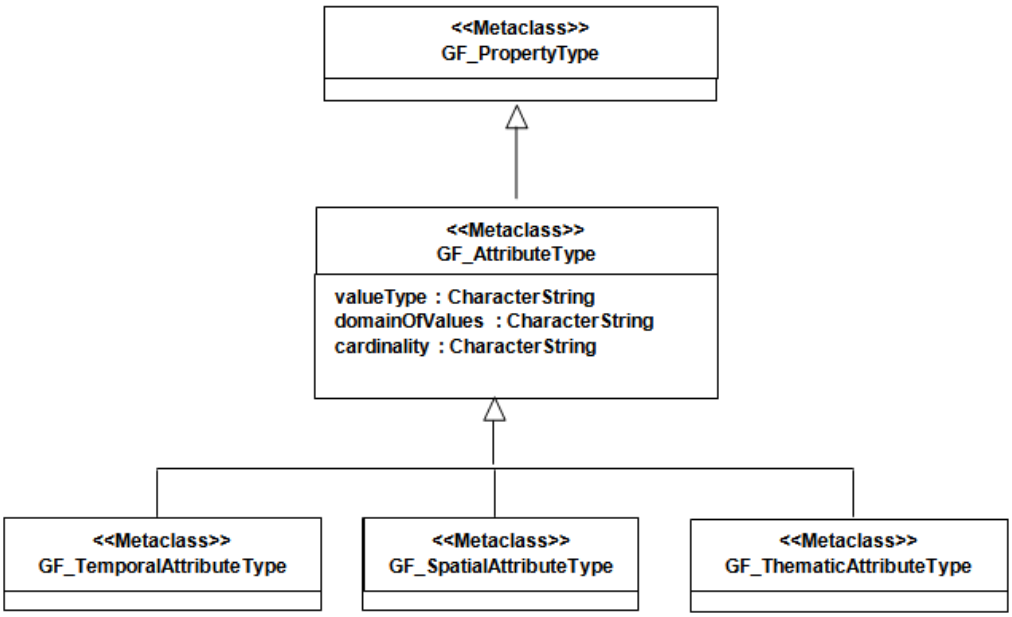
- UML package
- UML class
- UML relationship
- UML stereotype

Attributes of UML classes are presented by the following syntax:
[Range] attribute name [cardinality] [: data type] [= the value generated]

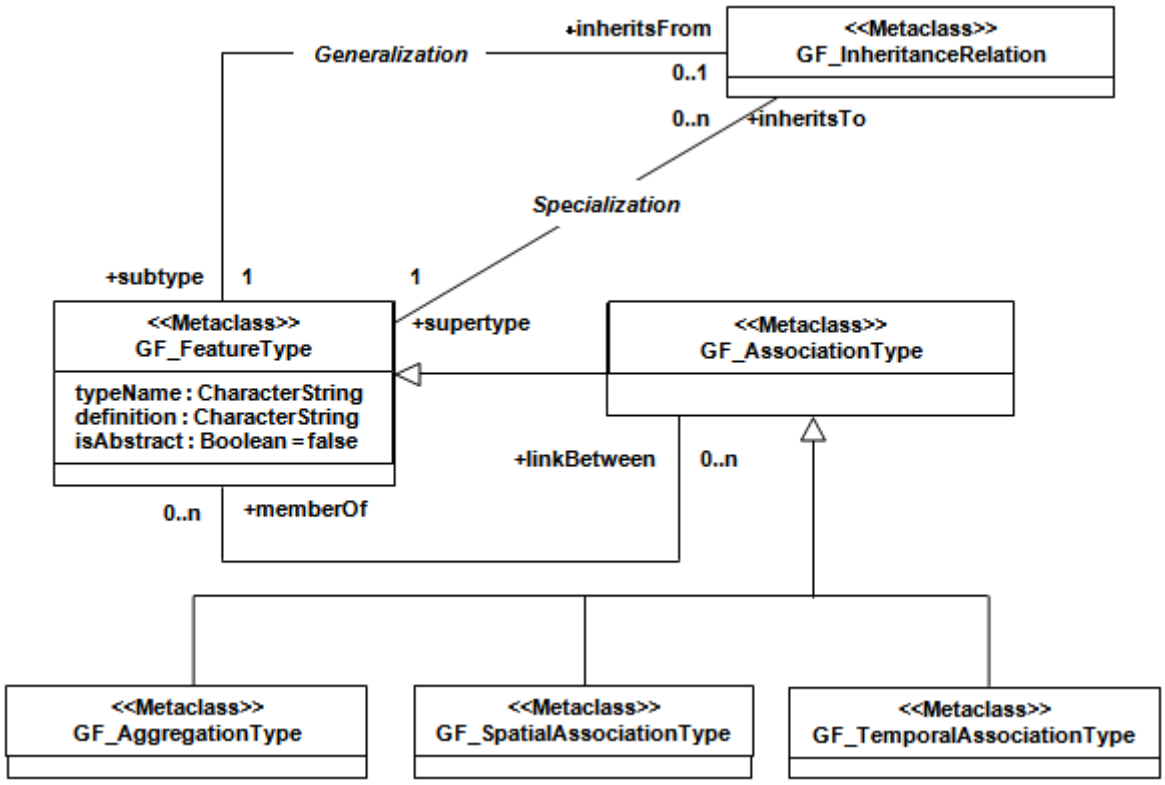
The general structure scheme of geographic data presented on the following diagram:



Attribute of geographic feature type is described by UML class scheme follows:



Relationship of geographic feature type is described by UML class scheme follows:



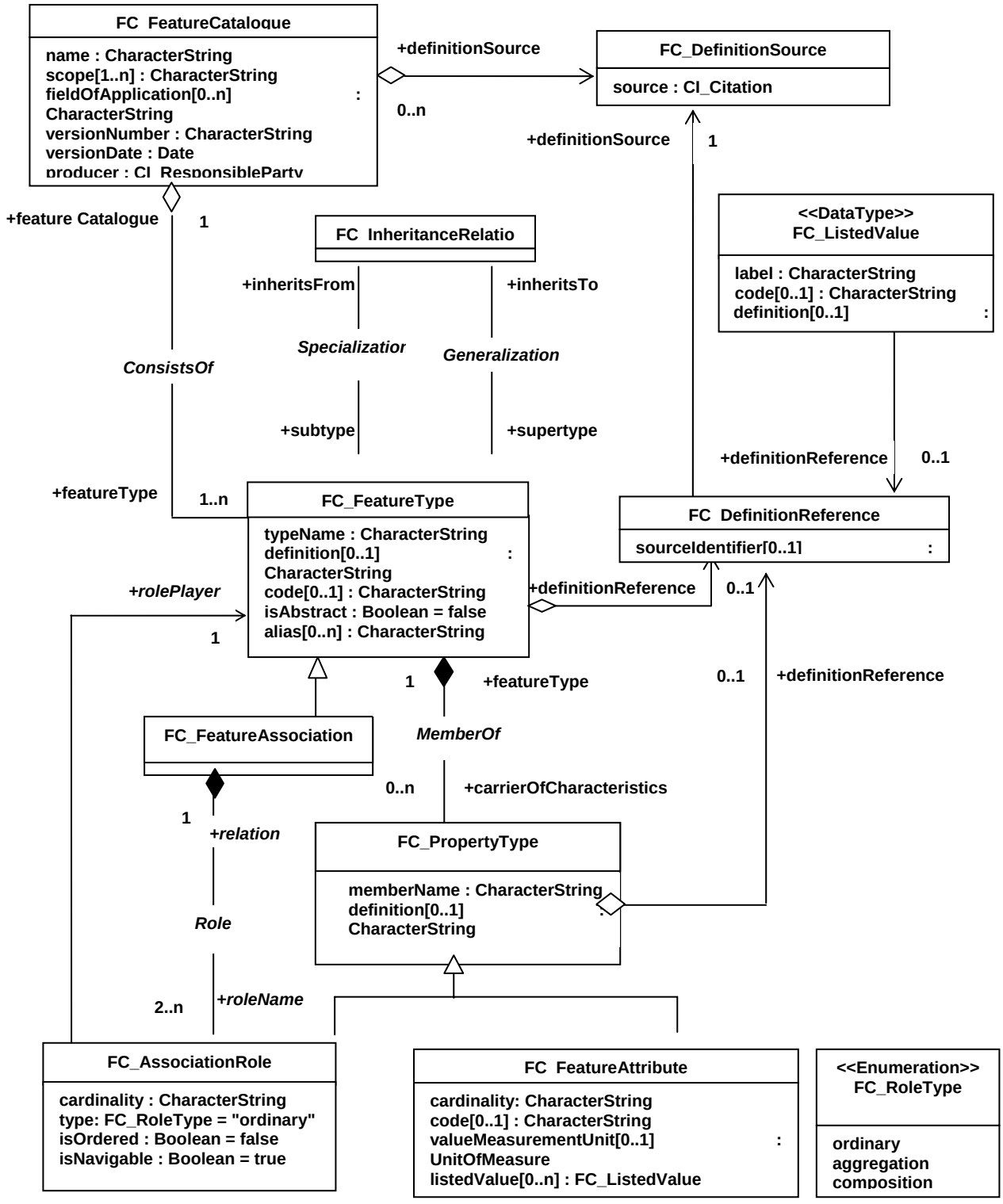
2.3 Standard for classification of geographic objects

Standard for classification geographical object used for the following purposes:

- To build the feature catalogue.
- To build database to provide information about the feature catalogue of geographical objects.

This standard regulations the information, names, definitions, feature type, attribute, relationship, detailed information should have in the feature catalogue.

Concept model of feature catalogue applied to determine the structure and content of information is performed in the language UML as follows:


FC_FeatureCatalogue
name : CharacterString
scope[1..n] : CharacterString
fieldOfApplication[0..n] : CharacterString
versionNumber : CharacterString
versionDate : Date
producer : CI_ResponsibleParty
+definitionSource
0..n
FC_DefinitionSource
source : CI_Citation
+definitionSource
1
+feature Catalogue
1
FC_InheritanceRelatio
+inheritsFrom
+inheritsTo
Specialization
Generalization
ConsistsOf
+subtype
+supertype
<<DataType>>
FC_ListedValue
label : CharacterString
code[0..1] : CharacterString
definition[0..1] :
+definitionReference
0..1
+featureType
1..n
FC_FeatureType
typeName : CharacterString
definition[0..1] : CharacterString
code[0..1] : CharacterString
isAbstract : Boolean = false
alias[0..n] : CharacterString
FC_DefinitionReference
sourceIdentifier[0..1] :
+rolePlayer
1
+definitionReference
0..1
1
+featureType
0..1
+definitionReference
FC_FeatureAssociation
MemberOf
0..n
+carrierOfCharacteristics
1
+relation
FC_PropertyType
memberName : CharacterString
definition[0..1] : CharacterString
Role
2..n
+roleName
FC_AssociationRole
cardinality : CharacterString
type: FC_RoleType = "ordinary"
isOrdered : Boolean = false
isNavigable : Boolean = true
FC_FeatureAttribute
cardinality: CharacterString
code[0..1] : CharacterString
valueMeasurementUnit[0..1] : UnitOfMeasure
listedValue[0..n] : FC_ListedValue
<<Enumeration>>
FC_RoleType
ordinary
aggregation
composition

Feature Catalog includes 177 objects, 102 attributes in 10 following themes:

- National borders, administration borders (25)
- Infrastructure (30)
- Residential (3)
- Geographical names(6)
- Topography (20)
- Coordinate Reference Systems (9)
- Transport Networks (35)
- Covered surface (13)
- Border (3)
- Hydrography (33)

2.4 Implementing

GIBS is required to apply uniformly to build geographical information systems.
These standards will be compulsory application when building the national basic geographic dât and other specific geographic data in area of natural resources and environment management.

It is encouraged to apply national basic geographic information for specific geographic information system in other industries. This aims to reach the using of the unified standards in all industries all over the country.

GIBS is a basis for building of Technical Rules for basic geographic data and specific geographic data such as standard for basic geographic data 1:2000, 1:5000; standard for basic geographic data 1:10000; standard for basic geographic data 1:50000; standard for cadastral data, etc…

3. TECHNICAL RULES FOR BASIC GEOGRAPHIC DATA

Based on GIBS, currently DOSMVN is building technical regulations for basic geographic data. These are:

- The technical regulations for basic geographic data 1:2000, 1:5000
- The technical regulations for basic geographic data 1:10000
- The technical regulations for basic geographic data 1:50000
- The technical regulations for basic geographic data 1:1000000

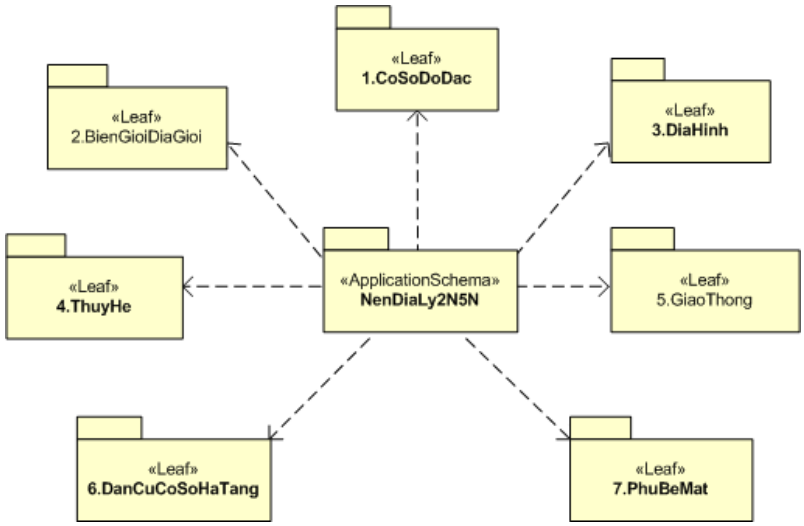
The technical regulations specified structure model and feature catalogue, referencing by coordinates, quality, metadata, presenting, encoding and sharing basic geographic data.

Basic geographic data includes seven data packages, these are following:

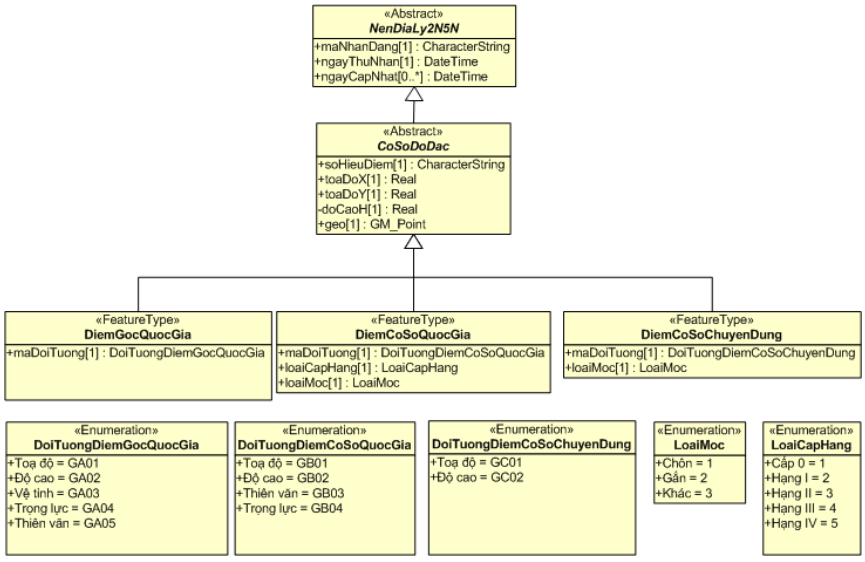
- Coordinate control points
- National and administration borders
- Topography
- Hydrography
- Transport Networks

- Residential and Infrastructure
- Covered surface

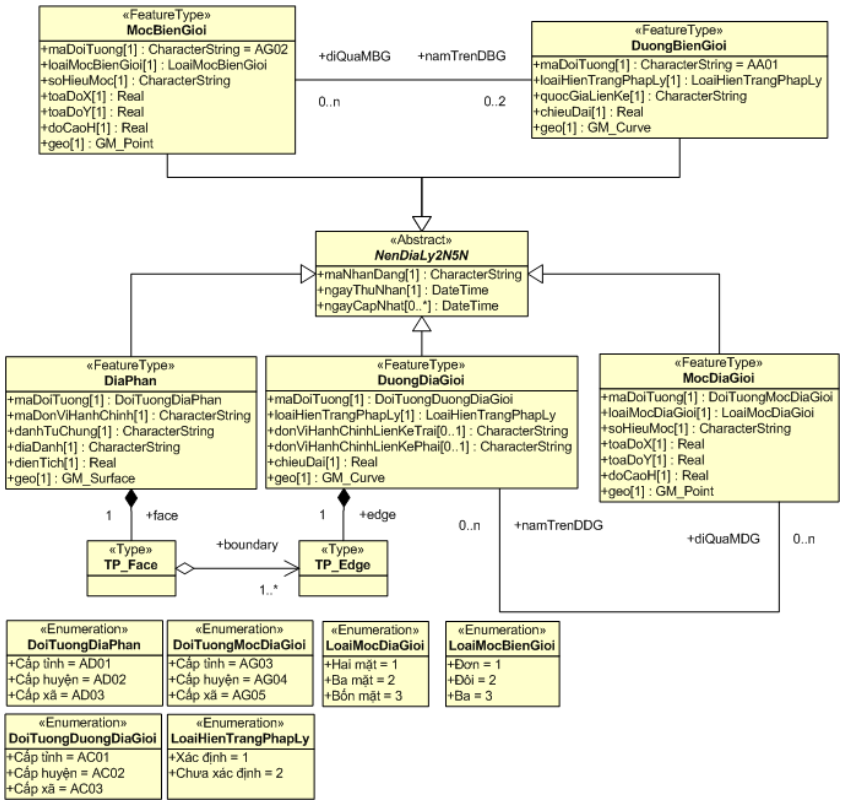
General structure model of basic geographic data as follows:



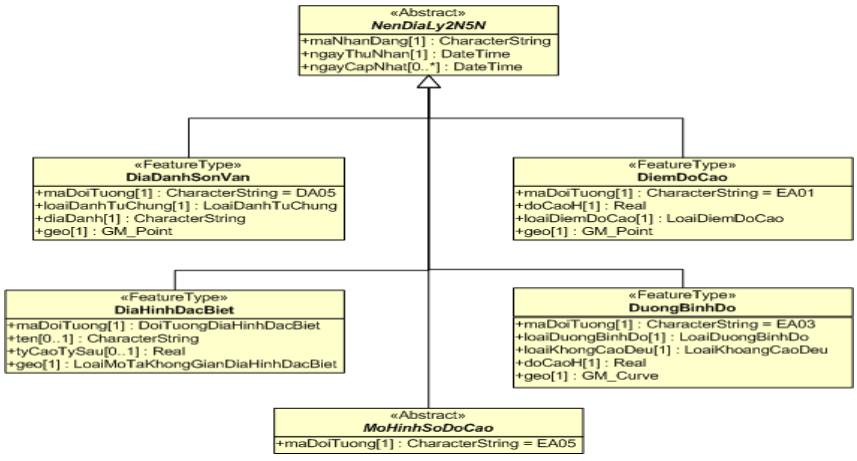
- Structure model for Coordinate control points:



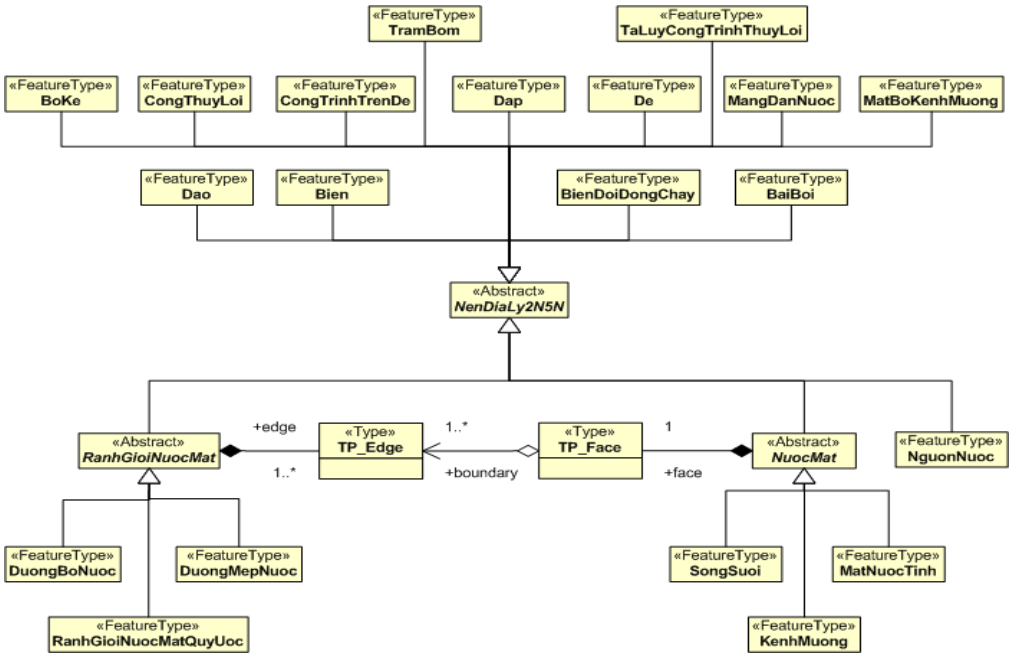
– Structure model for National and administration borders:



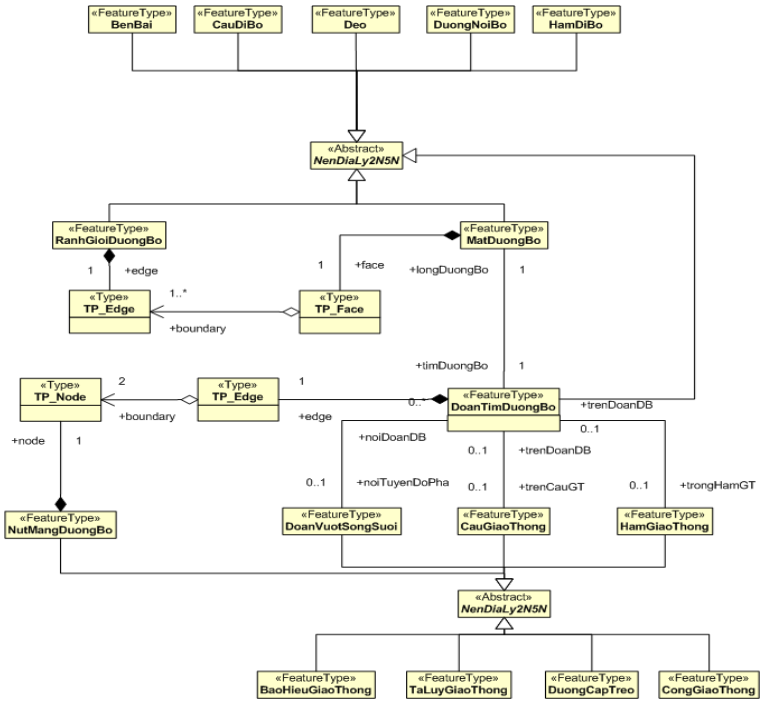
– Structure model for Topography:



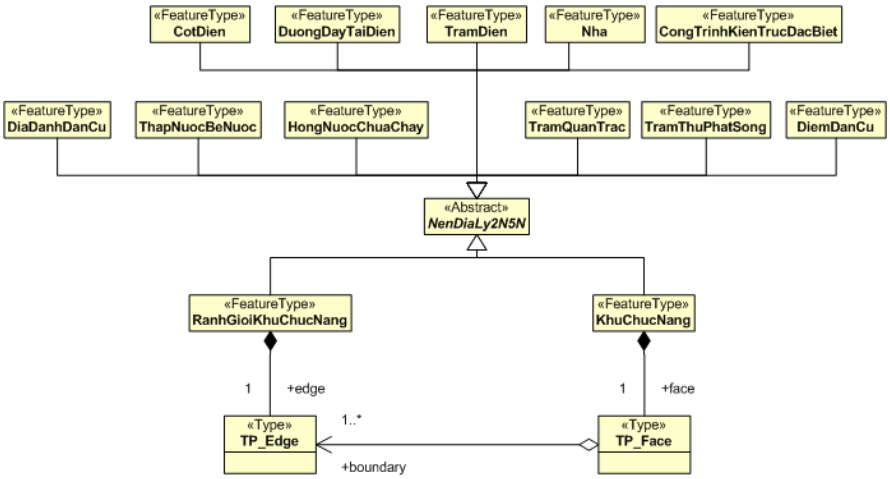
– Structure model for Hydrography:



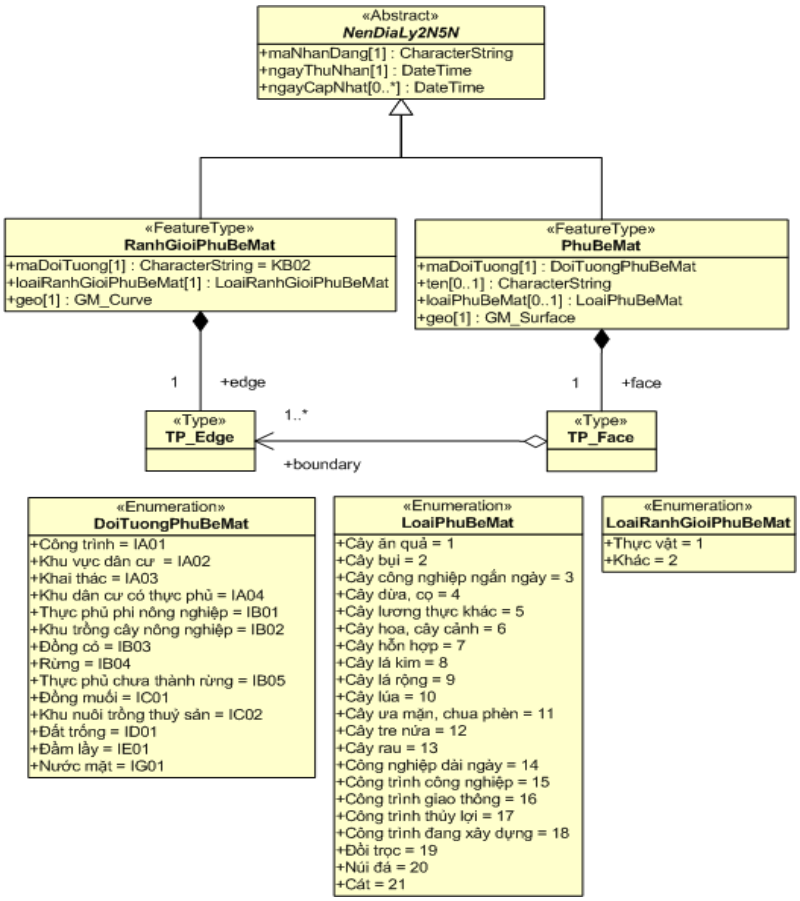
– Structure model for Transport Networks:



– Structure model for Residential and Infrastructure:



– Structure model for Covered surface:



These Technical Regulations are being applied to build the basic Geographic database.

4. CONCLUSION

Geographic Information Basic Standard and Technical Regulations for basic geographic data have been constructed in accordance with ISO and inheritance are regulated by the appropriate technical regulations have applied in Vietnam.

The build of Geographic Information Basic Standard and Technical Regulations for basic geographic data reached the objectives: Development of conceptual framework and specification methodology and development of data specifications for each data theme.

The application of the Geographic Information Basic Standard and the Technical Regulations for basic geographic data will create the database, easily updated, shared and effective.

REFERENCES

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BIOGRAPHICAL NOTES

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