Paper for Consideration by TSMAD and DIPWG

Modification of the Feature Catalogue Model

Motivation:

The motivation for the change in the feature catalogue model was to reflect the changes in the general feature model. In addition some cleanup has been done in the model to remove redundant information. The main change is that there are now two types of associations, feature and information association and that those can have attributes.

Background:

The GFM in S-100 Version 1.0.0 does not allow to associate information types by means of association types. In addition the feature association types are not allowed to carry thematic attributes. Both are required for the modeling of nautical publications. Since workarounds were not satisfying the situation, the GFM was modified. One side effect of these changes is that the model of the feature catalogue needs to be changed as well. These modifications are proposed in this document. In addition a new version of the feature catalogue schema (xsd) will be created.

Proposed changes (brief):

The main changes are:

- Add a new class **S100_FC_Item** to carry the common properties of all feature catalogue items. Those were repeated in three classes of the old model. This is only a cleanup and does not semantically changes the model.
- The class **S100_FC_PropertyType** was removed from the model. Derived classes are now derived from **S100_FC_Item**. The reason for this is that the removed class does not add any information to the model.
- The classes **S100_FC_InformationRole** and **S100_FC_AssociationRole** were replaced by only one class **S100_FC_Role** due to the changes in the GFM. (There is only one role type in the GFM now)
- There is a super class for **S100_FC_FeatureType** and **S100_FC_InformationType**: **S100_FC_ObjectType**. The reason for this is the common property '**informationBinding**'.
- A new class **S100_FC_InformationAssociation** was added to the model due to the change of the GFM.
- The classes **S100_FC_InformationAssociation** and **S100_FC_FeatureAssociation** are subject of inheritance now (to be in line with the GFM).

- The attribute '**permittedValues**' of **S100_FC_AttributeBinding** was changed into an association. This is not a semantically change of the model.
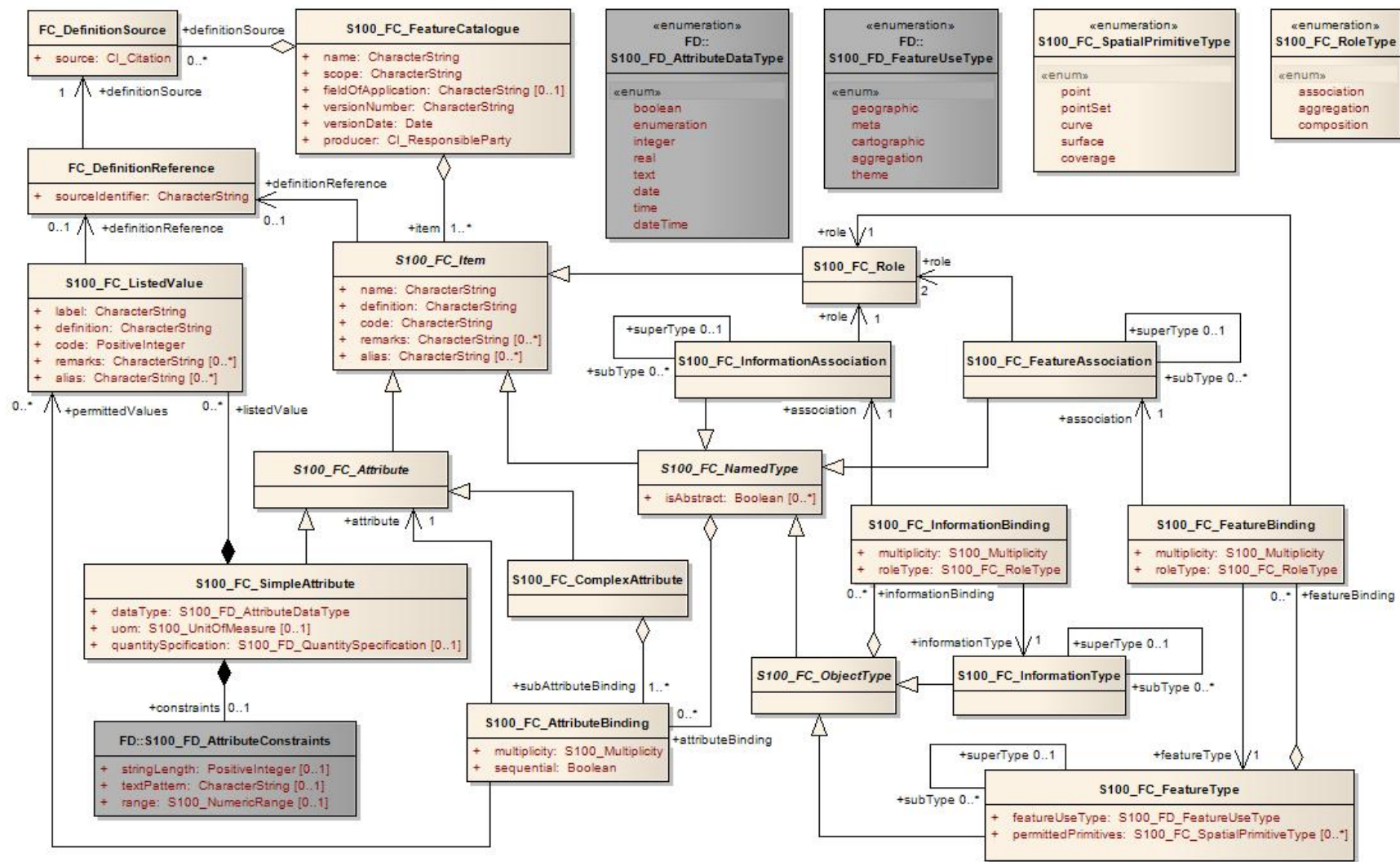
Proposed changes (detailed):

FC_DefinitionSource
+ source: CI_Citation

+definitionSource 0..*
1 +definitionSource

S100_FC_FeatureCatalogue
+ name: CharacterString
+ scope: CharacterString
+ fieldOfApplication: CharacterString [0..1]
+ versionNumber: CharacterString
+ versionDate: Date
+ producer: CI_ResponsibleParty

«enumeration»
FD::
S100_FD_AttributeDataType
«enum»
boolean
enumeration
integer
real
text
date
time
dateTime

«enumeration»
FD::
S100_FD_FeatureUseType
«enum»
geographic
meta
cartographic
aggregation
theme

«enumeration»
S100_FC_SpatialPrimitiveType
«enum»
point
pointSet
curve
surface
coverage

«enumeration»
S100_FC_RoleType
«enum»
association
aggregation
composition

FC_DefinitionReference
+ sourceIdentifier: CharacterString

+definitionReference 0..1
0..1 +definitionReference
+definitionReference 0..1

S100_FC_ListedValue
+ label: CharacterString
+ definition: CharacterString
+ code: PositiveInteger
+ remarks: CharacterString [0..*]
+ alias: CharacterString [0..*]

+item 1..*

S100_FC_Item
+ name: CharacterString
+ definition: CharacterString
+ code: CharacterString
+ remarks: CharacterString [0..*]
+ alias: CharacterString [0..*]

+role 1
+role 1
2
+role 1

S100_FC_Role

+superType 0..1
+subType 0..*

S100_FC_InformationAssociation

+superType 0..1
+subType 0..*

S100_FC_FeatureAssociation

+association 1
+association 1

0..* +permittedValues   0..* +listedValue

S100_FC_Attribute

S100_FC_NamedType
+ isAbstract: Boolean [0..*]

+attribute 1

S100_FC_InformationBinding
+ multiplicity: S100_Multiplicity
+ roleType: S100_FC_RoleType

S100_FC_FeatureBinding
+ multiplicity: S100_Multiplicity
+ roleType: S100_FC_RoleType

0..* +informationBinding
0..* +featureBinding

S100_FC_SimpleAttribute
+ dataType: S100_FD_AttributeDataType
+ uom: S100_UnitOfMeasure [0..1]
+ quantitySpecification: S100_FD_QuantitySpecification [0..1]

S100_FC_ComplexAttribute

+informationType 1
+superType 0..1

S100_FC_ObjectType

S100_FC_InformationType
+subType 0..*

+constraints 0..1

+subAttributeBinding 1..*
0..*

FD::S100_FD_AttributeConstraints
+ stringLength: PositiveInteger [0..1]
+ textPattern: CharacterString [0..1]
+ range: S100_NumericRange [0..1]

S100_FC_AttributeBinding
+ multiplicity: S100_Multiplicity
+ sequential: Boolean

+attributeBinding

+superType 0..1
+subType 0..*
+featureType 1

S100_FC_FeatureType
+ featureUseType: S100_FD_FeatureUseType
+ permittedPrimitives: S100_FC_SpatialPrimitiveType [0..*]

Figure 1 - The modified feature catalogue model

Elements of the model:

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_FeatureCatalogue	a feature catalogue contains its identification and contact information, and definition of some number of feature types with other information necessary for those definitions	-	-	
Attribute	name	name for this feature catalogue	1	CharacterString	
Attribute	scope	subject domain(s) of feature types defined in this feature catalogue	1	CharacterString	
Attribute	fieldOfApplication	description of kind(s) of use to which this feature catalogue may be put	0..1	CharacterString	
Attribute	versionNumber	version number of this feature catalogue, which may include both a major version number or letter and a sequence of minor release numbers or letters, such as "3.2.4a." The format of this attribute may differ between cataloguing authorities.	1	CharacterString	
Attribute	versionDate	effective date of this feature catalogue	1	Date	
Attribute	producer	name, address, country, and telecommunications address of person or organization having primary responsibility for the intellectual content of this feature catalogue	1	CI_ResponsibleParty	
Role	item	list of items defined by this feature catalogue; items are feature types, information types, feature associations, information associations, attributes, and roles	1..*	S100_FC_Item	aggregation
Role	definitionSource	list of sources of definitions of items, and listed values that are defined by this feature catalogue. Usually those sources are feature data dictionaries.	0..*	FC_DefinitionSource	aggregation

Table 1 - S100_FC_FeatureCatalogue

Role Name	Name	Description	Mult.	Type	Remarks
Class	FC_Definition_Source	class that specifies the source of a definition	-	-	
Attribute	source	actual citation of the source, sufficient to identify the document and how to obtain it	1	CI_Citation	

Table 2 - FC_DefinitionSource

Role Name	Name	Description	Mult.	Type	Remarks
Class	FC_DefinitionReference	class that links a data instance to the source of its definition	-	-	
Attribute	sourceIdentifier	information to locate the definition in the source document. The format of this information is specific to the structure of the source document.	1	CharacterString	
Role	definitionSource	the source of the definition	1	FC_DefinitionSource	

Table 3 - FC_DefinitionReference

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_Item	abstract base class that defines the common properties of all items in the feature catalogue; items are feature types, information types, feature associations, information associations, attributes and roles	-	-	abstract
Attribute	name	name of the item	1	CharacterString	
Attribute	definition	definition of the named type in a natural language	1	CharacterString	
Attribute	code	Code that uniquely identifies the named type within the feature catalogue. The format of the code (numeric, alphanumeric, etc.) will depend on the requirements of the product specification, and especially the encapsulation method.	1	CharacterString	
Attribute	remarks	further explanations about the item	0..*	CharacterString	
Attribute	alias	equivalent name(s) of this item	0..*	CharacterString	
Role	definitionReference	the link to the source of definition	0..1	FC_DefinitionReference	

Table 4 - S100_FC_Item

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_NamedType	abstract base class that defines the common properties for object types and associations	-	-	abstract; derived from S100_FC_Item
Attribute	isAbstract	Indicates if instances of this named type can exists in a geographic data set. Abstract types cannot be instantiated but serve as base classes for other (non-abstract) types.	1	Boolean	
Role	attributeBinding	list of bindings to attributes which describe the	0..*	S100_FC_AttributeBinding	aggregation

| | | characteristic of this named type | | | |

Table 5 - S100_FC_NamedType

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_ObjectType	abstract base class that defines the common properties for feature types and information types	-	-	abstract; derived from S100_FC_NamedType
Role	informationBinding	list of bindings to information types that can be associated to this object type by means of an information association	0..*	S100_FC_InformationBinding	aggregation

Table 6 - S100_FC_ObjectType

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_InformationType	class that defines all properties of an information type	-	-	derived from S100_FC_ObjectType
Role	superType	Indicates the information type from which an information type is derived. The sub type will inherit all properties from its super type: name, definition and code will usually be overridden by the sub type, although new properties may be added to the sub type.	0..1	S100_FC_InformationType	
Role	subType	Indicates the information types which are derived from an information type.	0..*	S100_FC_InformationType	

Table 7 - S100_FC_InformationType

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_FeatureType	class that defines all properties of a feature type	-	-	derived from S100_FC_ObjectType
Attribute	featureUseType	the use type of this feature type	1	S100_FD_FeatureUseType	
Attribute	permittedPrimitives	the combination of 0 or more spatial primitives permitted for feature type	0..*	S100_FC_SpatialPrimitiveType	
Role	featureBinding	list of bindings to feature types that can be related to this feature type by means of a feature association	0..*	S100_FC_FeatureBinding	aggregation
Role	superType	Indicates the feature type from which a feature type is derived. The sub type will inherit all properties from its	0..1	S100_FC_FeatureType	

Role Name	Name	Description	Mult.	Type	Remarks
		super type: name, definition and code will usually be overridden by the sub type, although new properties may be added to the sub type.			
Role	subtype	Indicates the feature types which are derived from a feature type.	0..*	S100_FC_FeatureType	

Table 8 - S100_FC_FeatureType

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_InformationAssociation	An information association describes the relationship between an object (feature or information type) and an information type. An information association is unidirectional and has only one role for the direction to the information type.	-	-	derived from S100_FC_NamedType
Role	role	the role of the association.	1	S100_FC_Role	
Role	superType	Indicates the information association from which an information association is derived. The sub type will inherit all properties from its super type: name, definition and code will usually be overridden by the sub type, although new properties may be added to the sub type.	0..1	S100_FC_InformationAssociation	
Role	subtype	Indicates the information associations which are derived from an information association.	0..*	S100_FC_InformationAssociation	

Table 9 - S100_FC_InformationAssociation

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_FeatureAssociation	A feature association describes the relationship between two feature types. A feature association is bidirectional and has a separate role for each direction.	-	-	derived from S100_FC_NamedType
Role	role	the roles of the association	2	S100_FC_Role	
Role	superType	Indicates the feature association from which a feature association is derived. The sub type will inherit all properties from its super type: name, definition and code will usually be overridden by	0..1	S100_FC_FeatureAssociation	

Role Name	Name	Description	Mult.	Type	Remarks
		the sub type, although new properties may be added to the sub type.			
Role	subtype	Indicates the feature associations which are derived from a feature association.	0..*	S100_FC_FeatureAssociation	

Table 10- S100_FC_FeatureAssociation

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_Role	a role which can be used in a feature association or an information association	-	-	derived from S100_FC_Item

Table 11 - S100_FC_Role

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_Attribute	Abstract base class for the two kinds of attributes: simple attributes and complex attributes. Attributes carry the characteristics of named types	-	-	abstract; derived from S100_FC_Item

Table 12 - S100_FC_Attribute

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_SimpleAttribute	attribute that carries a value	-	-	derived from S100_FC_Attribute
Attribute	dataType	the data type of this attribute	1	S100_FD_AttributeDataType	
Attribute	uom	unit of measure used for values of this feature attribute	0..1	S100_UnitOfMeasure	
Attribute	quantitySpecification	the physical quantity	0..1	S100_FD_QuantitySpecification	
Role	constraints	constraints which may apply to the attribute	0..1	S100_FD_AttributeConstraints	composition
Role	listedValues	set of listed values for an enumerated attribute domain	0..*	S100_FC_ListedValue	composition; applies only if data type is enumeration

Table 13 - S100_FC_SimpleAttribute

Role Name	Name	Description	Mult.	Type	Remarks

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_ComplexAttribute	a complex attribute consists of a list of sub-attributes which can be both simple or complex attributes	-	-	derived from S100_FC_Attribute
Role	subAttributeBinding	list of bindings to the sub-attributes	1..*	S100_FC_AttributeBinding	aggregation

Table 14 - S100_FC_ComplexAttribute

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_ListedValue	value of an enumerated attribute domain, including its codes and definition	-	-	
Attribute	label	descriptive label that uniquely identifies one value in the attribute domain	1	CharacterString	
Attribute	definition	definition of the listed value in a natural language	1	CharacterString	
Attribute	code	Numeric code that uniquely identifies the listed value in the attribute domain. This code should be identical with the code in the feature concept dictionary, if any.	1	PositiveInteger	
Attribute	remarks	further explanations about the listed value	0..*	CharacterString	
Attribute	alias	equivalent name(s) of this listed value	0..*	CharacterString	
Role	definitionReference	the link to the source of the definition	0..1	FC_DefinitionReference	

Table 15 - S100_FC_ListedValue

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_AttributeBinding	class that is used to describe the specifics of how an attribute is bound to a particular named type or a complex attribute	-	-	
Attribute	multiplicity	multiplicity defining how many instances of the attribute can be part of the named type or complex attribute	1	S100_Multiplicity	
Attribute	sequential	describes if the sequence of the attributes is meaningful or not	1	Boolean	Applies only to attributes which may occur more than once.
Role	permittedValues	permissible values of this attribute	0..*	S100_FC_ListedValue	Applies only to attribute of data type enumeration.
Role	attribute	the attribute that is bound to the item or the complex attribute	1	S100_FC_Attribute	

Table 16 - S100_FC_AttributeBinding

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_InformationBinding	class describing the use of an information type by an object type	-	-	
Attribute	multiplicity	defining how many instances of the target information type can be linked to one instance of the object type	1	S100_Multiplicity	
Attribute	roleType	the nature of the association end	1	S100_FC_RoleType	
Role	association	the association used for the binding; defining also the role	1	S100_FC_InformationAssociation	
Role	informationType	the target information type	1	S100_FC_InformationType	

Table 17 - S100_FC_InformationBinding

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_FC_FeatureBinding	class describing the relationship from one feature type to another feature type by means of a feature association	-	-	
Attribute	multiplicity	multiplicity defining how many instances of the target feature type can be linked to one instance of the source feature type	1	S100_Multiplicity	
Attribute	roleType	the nature of the association end	1	S100_FC_RoleType	
Role	association	the association used for the binding	1	S100_FC_FeatureAssociation	
Role	role	The role used for the binding. It must be part of the association used for the binding and defines the end of the association.	1	S100_FC_Role	
Role	featureType	the target feature type	1	S100_FC_FeatureType	

Table 18 - S100_FC_FeatureBinding

Role Name	Name	Description	Remarks
Enumeration	S100_FC_SpatialPrimitiveType	specifies spatial primitives permitted for use with a feature instance	
Literal	point	point spatial primitive	GM_Point
Literal	pointSet	point set spatial primitive	
Literal	curve	curve spatial primitive	
Literal	surface	surface spatial primitive	
Literal	coverage	coverage spatial primitive	

Table 19 - S100_FC_SpatialPrimitiveType

Role Name	Name	Description	Remarks
Enumeration	S100_FC_RoleType	defines the nature of a role	
Literal	association	An association is used to describe a relationship between two feature types that involves connections between their instances.	
Literal	aggregation	An aggregation association is a relationship between two feature types, in which one of the feature types plays the role of a container and the other plays the role of a containee.	
Literal	composition	A composition association is a strong aggregation. In a composition association, if a container object is deleted then all of its containee objects are deleted as well. With other words containee objects cannot exists without the container object.	

Table 20 - S100_FC_RoleType