Paper for Consideration by the S-100WG

Primary association between feature types

Submitted by:	SevenCs GmbH – Holger Bothien
Executive Summary:	The paper discusses the primary association between feature types
Related document(s):	S-100 Ed 5 several parts

Introduction / Background

The general feature model in S-100 describes that feature types can have associations to other feature types. See S-100 Figure 3.1.

The association can have roles (0 to 2) and can carry thematic attributes.

In the feature catalogue model this concept is implemented by the feature binding – 5-4.2.5.2.

Currently the association is described in both feature types to allow to specify the role types and cardinalities.

The following is written in this clause:
Note that data formats may impose constraints on whether bindings are actually encoded in either of the participating feature instances in datasets.

This happens for the ISO8211 encoding: 10a - 5.10.1

> *Note that only one direction of the relationship has to be encoded explicitly, the other direction is always implicit. For example an aggregation object has encoded the relationships to its parts but there is no explicit encoding for the relationships from the parts to the aggregation object.*

Analysis/Discussion

There is no mechanism to find out which direction of the relationship must be encoded, and which must not.

The easiest way to achieve that is to extend the FC model that an attribute ‘primary’ is added to the FC model for feature bindings.

Another way is to only specify the primary relation in the FC. Then the role type and the cardinality for the inverse relation must be added to the binding type. The inverse role is implicitly defined by the association type. The author clearly is in favour of this approach.

The second option will reduce the possibility of inconsistencies in the FC. A binding exists in feature type A (to feature type B) but the inverse binding does not exists or is using a different association type.

Note that both solutions will make old feature catalogues not compliant but that can be solved by a new namespace.

It is further worth to be mentioned that these extensions are mostly necessary for creating datasets for ISO8211 encoding. The reading software will not need that information.

Note that for the information association the situation is similar but slightly more complex.

- From feature to information type the binding can only be at the feature type
- From information type to information type the situation is like the feature association issue, a primary property is required or only one direction defined by the FC
- From spatial types to feature types is no possibility to define the bindings in the FC

The best solution will be here as well to only define the 'primary' relation (for the feature to information type it is already the case.

The spatial types to information types needs a different solution. One idea is to specify that an information association can be used by spatial types. In the information association a property must be added for that in the FC model (optional).

Conclusions

The author would prefer to only store one binding for an association and extend the model accordingly by adding an inverse role attribute and an inverse element. Both elements can be optional it must be clear what the values in this case are.

The same must be done for the information binding.

The information association should have a Boolean property if it can be used by a spatial type.

The example in part 5 would change from

In the TrafficSeparationScheme:

```
<S100FC:featureBinding roleType="association">
   <S100FC:multiplicity>
      <S100Base:lower>0</S100Base:lower>
      <S100Base:upper xsi:nil="true" infinite="true"/>
   </S100FC:multiplicity>
   <S100FC:association ref="TrafficSeparationSchemeAggregation"/>
   <S100FC:role ref="consistsOf"/>
   <S100FC:featureType ref="TrafficSeparationSchemeLanePart"/>
</S100FC:featureBinding>
```

In TrafficSeparationSchemeLanePart:

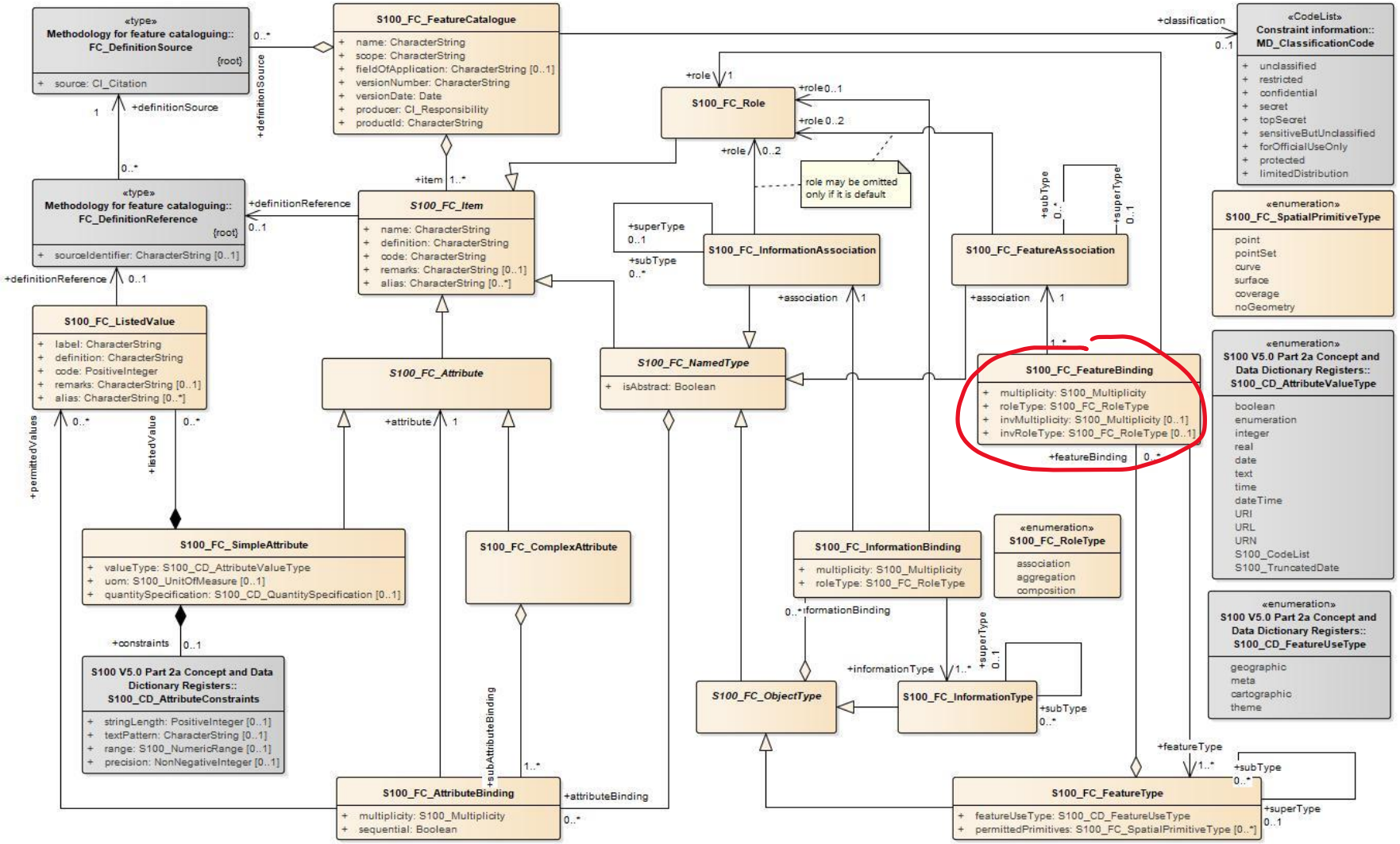
```
<S100FC:featureBinding roleType="aggregation">
   <S100FC:multiplicity>
      <S100Base:lower>0</S100Base:lower>
      <S100Base:upper xsi:nil="false" infinite="false">1</S100Base:upper>
   </S100FC:multiplicity>
   <S100FC:association ref="TrafficSeparationSchemeAggregation"/>
   <S100FC:role ref="componentOf"/>
   <S100FC:featureType ref="TrafficSeparationScheme"/>
</S100FC:featureBinding>
```

To only have in TrafficSeparationScheme:

```
<S100FC:featureBinding roleType="association" invRoleType=="aggregation">
   <S100FC:multiplicity>
      <S100Base:lower>0</S100Base:lower>
      <S100Base:upper xsi:nil="true" infinite="true"/>
   </S100FC:multiplicity>
   <S100FC:invMultiplicity>
      <S100Base:lower>0</S100Base:lower>
      <S100Base:upper xsi:nil="false" infinite="false">1</S100Base:upper>
   </S100FC:invMultiplicity>
```

```
      <S100FC:association ref="TrafficSeparationSchemeAggregation"/>
      <S100FC:role ref="consistsOf"/>
      <S100FC:featureType ref="TrafficSeparationSchemeLanePart"/>
   </S100FC:featureBinding>
```

The model would look like.


«type»
Methodology for feature cataloguing::
FC_DefinitionSource
{root}
+ source: CI_Citation
S100_FC_FeatureCatalogue
+ name: CharacterString
+ scope: CharacterString
+ fieldOfApplication: CharacterString [0..1]
+ versionNumber: CharacterString
+ versionDate: Date
+ producer: CI_Responsibility
+ productId: CharacterString
+classification
«CodeList»
Constraint information::
MD_ClassificationCode
+ unclassified
+ restricted
+ confidential
+ secret
+ topSecret
+ sensitiveButUnclassified
+ forOfficialUseOnly
+ protected
+ limitedDistribution
+definitionSource
+definitionSource
«type»
Methodology for feature cataloguing::
FC_DefinitionReference
{root}
+ sourceIdentifier: CharacterString [0..1]
+definitionReference
+definitionReference
S100_FC_Item
+ name: CharacterString
+ definition: CharacterString
+ code: CharacterString
+ remarks: CharacterString [0..1]
+ alias: CharacterString [0..*]
+item
S100_FC_Role
+role
+role
role may be omitted
only if it is default
S100_FC_InformationAssociation
+superType
+subType
S100_FC_FeatureAssociation
+subType
+superType
«enumeration»
S100_FC_SpatialPrimitiveType
point
pointSet
curve
surface
coverage
noGeometry
+association
+association
S100_FC_ListedValue
+ label: CharacterString
+ definition: CharacterString
+ code: PositiveInteger
+ remarks: CharacterString [0..1]
+ alias: CharacterString [0..*]
S100_FC_Attribute
+attribute
S100_FC_NamedType
+ isAbstract: Boolean
S100_FC_FeatureBinding
+ multiplicity: S100_Multiplicity
+ roleType: S100_FC_RoleType
+ invMultiplicity: S100_Multiplicity [0..1]
+ invRoleType: S100_FC_RoleType [0..1]
+featureBinding
«enumeration»
S100 V5.0 Part 2a Concept and
Data Dictionary Registers::
S100_CD_AttributeValueType
boolean
enumeration
integer
real
date
text
time
dateTime
URI
URL
URN
S100_CodeList
S100_TruncatedDate
+permittedValues
+listedValue
S100_FC_SimpleAttribute
+ valueType: S100_CD_AttributeValueType
+ uom: S100_UnitOfMeasure [0..1]
+ quantitySpecification: S100_CD_QuantitySpecification [0..1]
S100_FC_ComplexAttribute
S100_FC_InformationBinding
+ multiplicity: S100_Multiplicity
+ roleType: S100_FC_RoleType
«enumeration»
S100_FC_RoleType
association
aggregation
composition
+informationBinding
+constraints
S100 V5.0 Part 2a Concept and Data
Dictionary Registers::
S100_CD_AttributeConstraints
+ stringLength: PositiveInteger [0..1]
+ textPattern: CharacterString [0..1]
+ range: S100_NumericRange [0..1]
+ precision: NonNegativeInteger [0..1]
+subAttributeBinding
+informationType
+superType
S100_FC_ObjectType
S100_FC_InformationType
+subType
«enumeration»
S100 V5.0 Part 2a Concept and
Data Dictionary Registers::
S100_CD_FeatureUseType
geographic
meta
cartographic
theme
+featureType
+subType
S100_FC_AttributeBinding
+ multiplicity: S100_Multiplicity
+ sequential: Boolean
+attributeBinding
S100_FC_FeatureType
+ featureUseType: S100_CD_FeatureUseType
+ permittedPrimitives: S100_FC_SpatialPrimitiveType [0..*]
+superType

Note that the schema must be changed as well.

Recommendations

To increase the usability of the standard and remove possible inconsistencies in the FCs it is recommended to change the part 5 of the standard

Action Required by the S-100WG

The S-100WG is invited to:

a. Note this paper
b. Discuss this paper
c. Decide what should be the best way forward