Paper for Consideration by TSMAD/DIPW

Associations, Aggregations, and Compositions

Submitted by:	TSMAD Vice Chair
Executive Summary:	This paper tries to clarify the use of Associations, Aggregations and Compositions within S-101 and the DCEG
Related Documents:	S-100, S-101, S-101 DCEG
Related Projects:	N/A

Introduction / Background

During the development of the S-101 Product Specification and the Data Classification and Encoding Guide it has been recognized that the guidance in S-100 on the use of Associations, Aggregations and Compositions may or may not be entirely clear. This paper seeks to provide some clarity and an opportunity to review the existing Associations, Aggregations and Compositions that are used in S-101.

Analysis/Discussion

S-100

S-100 defines Associations, Aggregations and Compositions in several places.

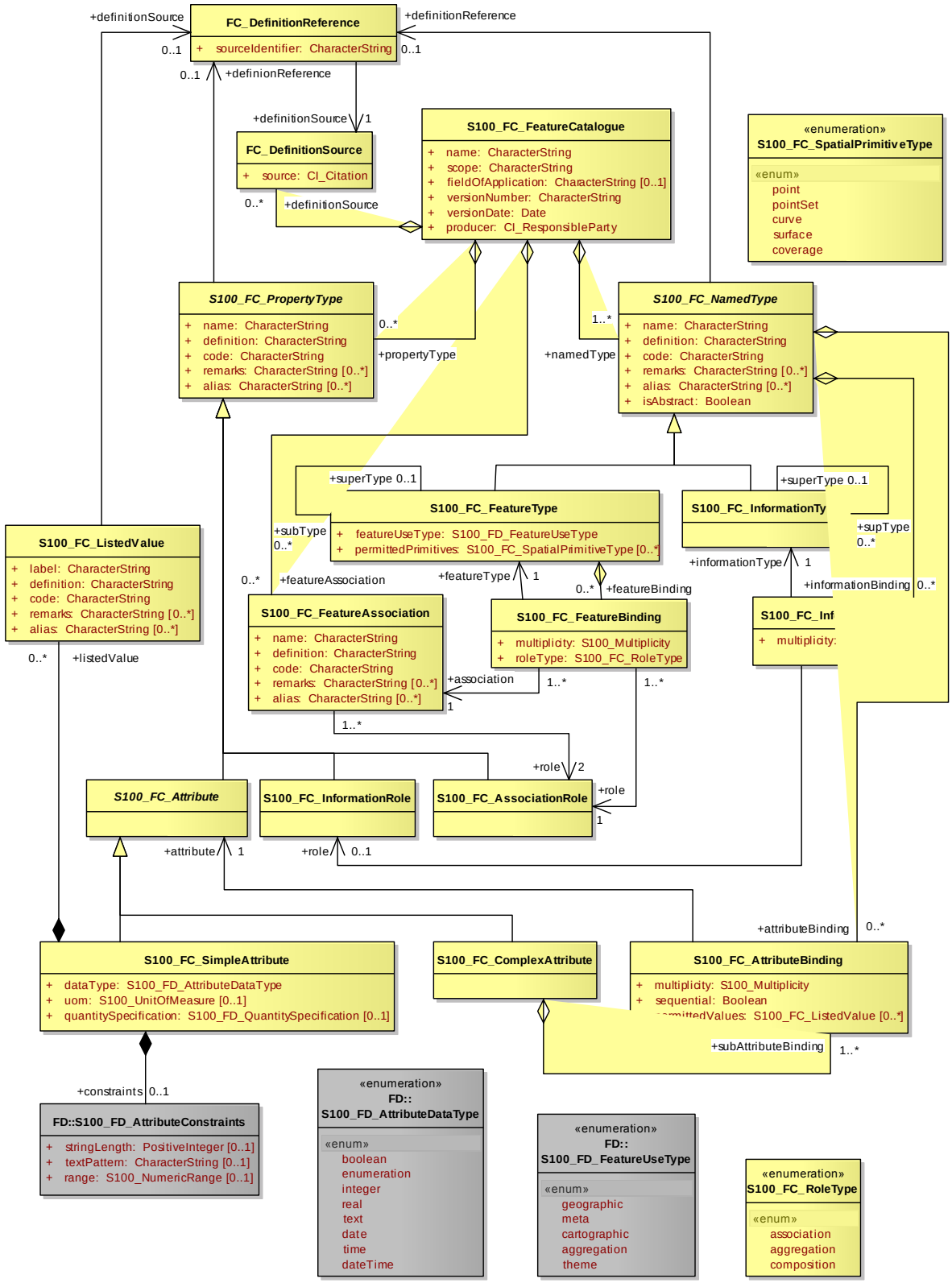
Part 1- Conceptual Schema Language
Part one describes the modelling language that is used in S-100 and states the following:

Association – a semantic connection between two instances
Aggregation – A part-of relationship
Composition – Strong Aggregation, children are deleted if parent is deleted.

These general definitions are future expanded upon in the Feature Catalogue part of S-100.

Part 5 – Feature Catalogue Model (Appendix 5-A)

The feature catalogue also uses associations, aggregations and compositions and they use the same definitions that are used in Part 1. However, in the Feature Catalogue they are part of S100_FC_FeatureBinding. Here it uses an attribute called roleType that calls the enumerated list S100_FC_RoleType.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+definitionReference
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+ source: CI_Citation
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+ scope: CharacterString
+ fieldOfApplication: CharacterString [0..1]
+ versionNumber: CharacterString
+ versionDate: Date
+ producer: CI_ResponsibleParty
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S100_FC_SpatialPrimitiveType
«enum»
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pointSet
curve
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coverage
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+namedType
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+ remarks: CharacterString [0..*]
+ alias: CharacterString [0..*]
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+superType 0..1
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+ permittedPrimitives: S100_FC_SpatialPrimitiveType [0..*]
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+featureAssociation
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+featureBinding
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+ remarks: CharacterString [0..*]
+ alias: CharacterString [0..*]
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+ definition: CharacterString
+ code: CharacterString
+ remarks: CharacterString [0..*]
+ alias: CharacterString [0..*]
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+ multiplicity: S100_Multiplicity
+ roleType: S100_FC_RoleType
S100_FC_Inf
+ multiplicity:
+association
+role
S100_FC_Attribute
S100_FC_InformationRole
S100_FC_AssociationRole
+attribute
+role
S100_FC_SimpleAttribute
+ dataType: S100_FD_AttributeDataType
+ uom: S100_UnitOfMeasure [0..1]
+ quantitySpecification: S100_FD_QuantitySpecification [0..1]
S100_FC_ComplexAttribute
S100_FC_AttributeBinding
+ multiplicity: S100_Multiplicity
+ sequential: Boolean
+attributeBinding
+subAttributeBinding
+constraints
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+ stringLength: PositiveInteger [0..1]
+ textPattern: CharacterString [0..1]
+ range: S100_NumericRange [0..1]
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FD::
S100_FD_AttributeDataType
«enum»
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enumeration
integer
real
text
date
time
dateTime
«enumeration»
FD::
S100_FD_FeatureUseType
«enum»
geographic
meta
cartographic
aggregation
theme
«enumeration»
S100_FC_RoleType
«enum»
association
aggregation
composition

S100_FC_FeatureBinding

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	featureType	the target feature type	1	S100_FC_FeatureType	
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_AssociationRole	
Role	association	the association used for the binding.	1	S100_FC_FeatureAssociation	

S100_FC_RoleType

Role Name	Name	Description	Comments
Enumeration	S100_FC_RoleType	defines the type 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.	

In addition, to the FC_RoleType used for feature bindings S-100 also defines a feature use type called an aggregated Feature – where a feature is made up of component features.

S-101

Currently, S-101 utilizes the following from S-100 and defines them as follows:

Feature Relationship

A feature relationship links instances of one feature type with instances of the same or a different feature type. There are three types of defined feature relationships in S-101 as described in the following sub clauses.

Association
An association is used to describe a relationship between two feature types that involves connections between their instances.

EXAMPLE A **Pilot Boarding Place** feature provides a boarding location for a **Pilotage District** feature. An association named **District boarding locations** is used to relate the two features; roles are used to convey the meaning of the relationship.

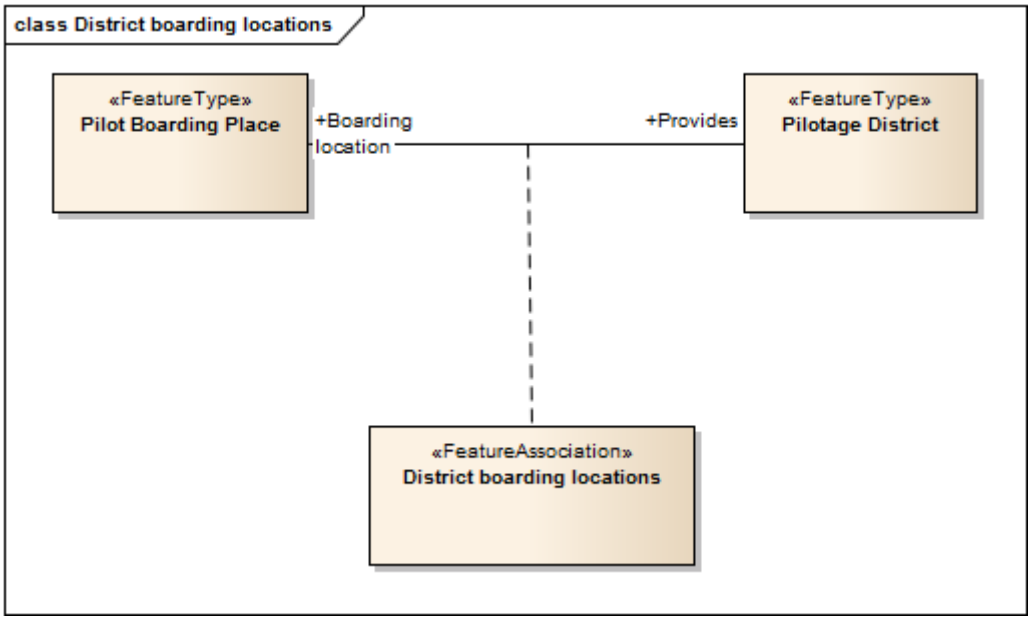

Figure 1 - Association

Aggregation

An aggregation is a relationship between two or more feature types where the aggregation feature is made up of component features.

EXAMPLE **Bridge** feature of type aggregation may be composed of multiple **Span** features and may also include **Lights** and other features which make up the **Bridge**

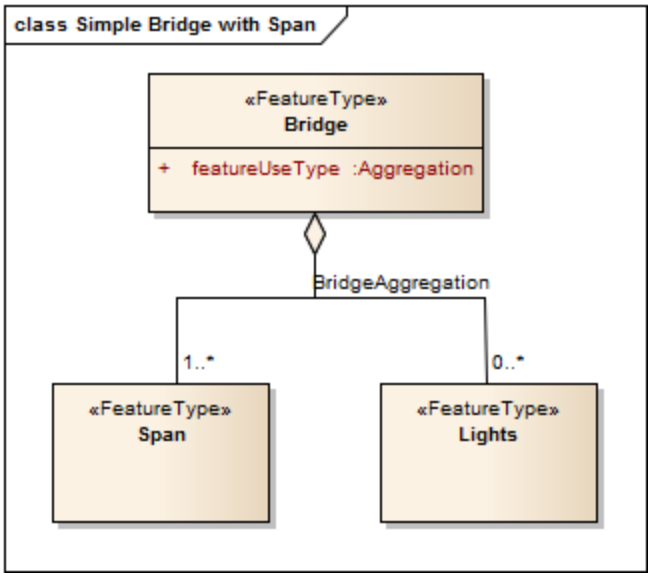

Figure 2 - Aggregation

Composition

A composition is a strong aggregation. In a composition, if a container object is deleted then all of its containee objects are deleted as well.

EXAMPLE If a feature type of TSS is deleted, then all of its component feature types that make up the TSS are deleted as they make up the **Routeing Measure** Composition.

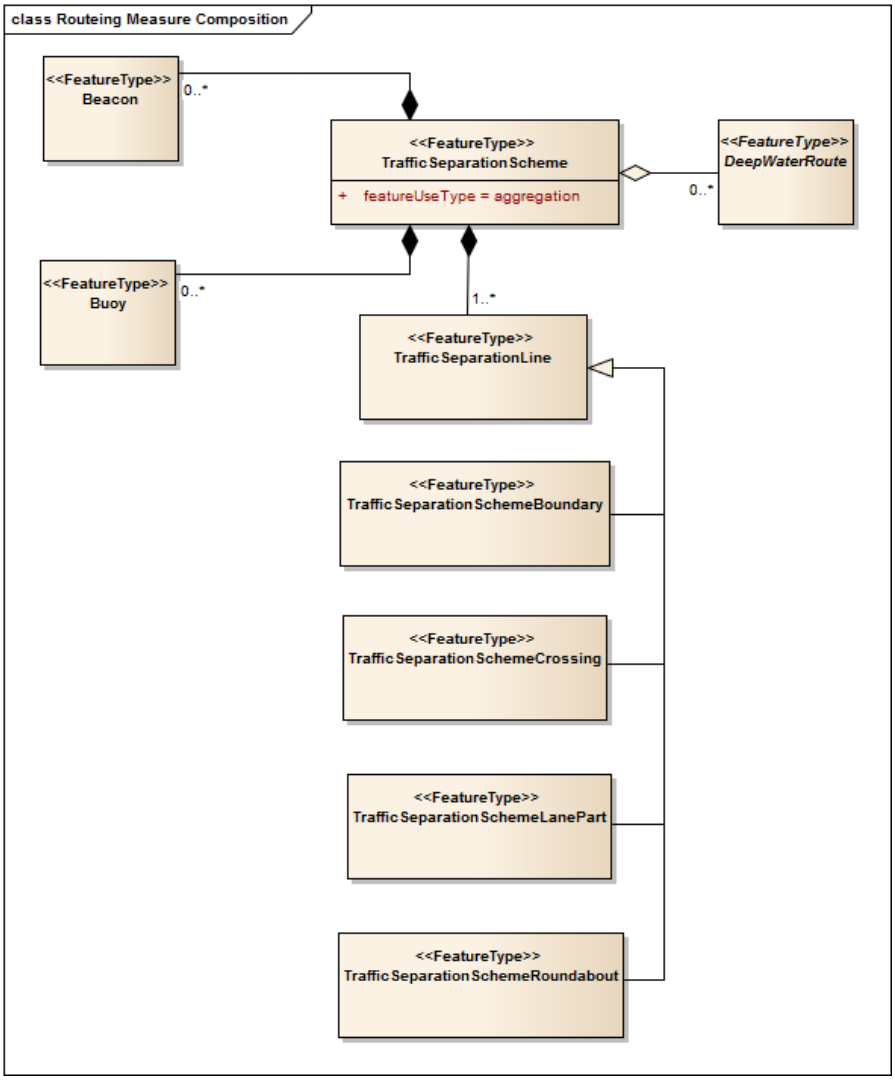

Figure 3 - Composition

In addition to the different types of feature relationships, S-101 also makes use of the aggregated feature type – which is defined as a feature which is made up of component features and refers the user to the clause on aggregated feature relationships for an example. It should be noted that an aggregated featuretype does not have any geometry, however, S-100 does not explicitly state that there should be no geometry on this type of feature.

S-101 Data Classification and Encoding Guide

The S-101 DCEG has identified the following as Named Compositions, Named Aggregations and Feature Associations.

- Named Compositions
    - Archipelagic Sea Lane
    - Deep Water Route
    - Traffic Separation Scheme
    - Two-Way route
- Named Aggregations
    - Bridge
    - Island Group
- Feature Associations
    - Additional Information
    - District Boarding Locations
    - Structure/Equipment
    - Updated Information
    - Text Placement

While reviewing the baseline DCEG in preparation for creating the S-101 feature catalogue it was noted that the Named Aggregation Bridge also included geometric primitives, which according to the S-100 gurus aggregations should not have primitives. There could still be a named aggregation for Bridge – but it should be composed of the component geo features and only carry attribution that gives the name of the bridge so it does not have to be repeated in both the fixed and open span features.

Conclusions

This investigation has highlighted a few issues:

- The DCEG subworking group should review the existing compositions, aggregations and associations to see if they are useful.
- S-101 should clarify that S100_FC_Roletype will be used to note if it is an aggregation, association or composition
- Should there really be a distinction between aggregations and compositions? Perhaps everything should be just a composition.
- S-100 should state that if the featureUseType = aggregation is being used then there should be no geometry associated with it. This instruction should then be carried through to S-101 along with improving the featureUseType example
- Does S-101 even need to use the featureUseType = aggregation, when it can just use the roleType aggregation to show that there is a feature relationship.

Action Required of TSMAD/DIPWG:

The TSMAD DCEG subworking group is invited to:

a. discuss the issues highlighted above and report any actions to TSMAD28.