Paper for consideration by S-101 Project Team

Super-types for S-101

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Executive Summary:	Draft type hierarchy for the S-101 application schema and feature catalogue
Related Documents:	(1) S-100WG1-8.17A Inheritance in Feature Catalogues; (2) S-100 change proposal 17 – FC Supertypes; (3) S-101PT1-3.6 DCEG issues
Related Projects:	(1) S-101

1   Introduction/Background

While reviewing the draft XML feature catalogue for S-101 which was distributed recently, we realized that completing the feature catalogue would be quite cumbersome in the absence of a type hierarchy for S-101 features and information types. This document therefore describes a draft hierarchy of feature and information types for the S-101 application schema and feature catalogue.

2   Analysis/Discussion

S-101 has some associations, specifically **text association** and **additional information**, which apply to all geo features. There are also other associations which apply to fewer but still several feature types, e.g., the structure/equipment association. Given the large number of geo features in S-101, the absence of a type hierarchy in the feature catalogue means that these associations must be duplicated in multiple feature types, which makes feature catalogues more susceptible to human error and increases their size.

We therefore request that the S-101 project team consider including a type hierarchy in the S-101 feature catalogue, and have prepared a draft type hierarchy for consideration. The figure provided later in this paper depicts the type hierarchy in compact form.

In the interests of compactness and clarity, UML conventions for class diagrams are not followed and the points below should be kept in mind when interpreting it:

- Super-type/subtype relationships are depicted by either contained boxes or feature type lists, e.g., **TextPlacement** is a subtype of the abstract type **UpdatedFeatures**; **Building** is a subtype of the abstract type **StructureFeatures**;

- Prefixes indicate the type hierarchy e.g., features **LightAllAround** and **LightSectored** are both at the lowest level of the type hierarchy **UpdatedFeatures → InformedFeatures → AllGeoFeatures → EquipmentFeatures.**

- To reduce the complexity of the diagram, a type may appear in both name list and box forms, e.g., **DeepWaterRouteCentreline** and **DeepWaterRoutePart** are listed inside **TSSchemesFeatures** as well as the name of the box aggregated to **DeepWaterRoute**.

Association, aggregation, and composition relationships are intended to conform to the April 2014 baseline version of the S-101 DCEG, corrected where the DCEG appears to exchange roles.

Definitions of the new abstract types are given in the table that follows the figure. The new abstract super-types do not have any attributes, but obviously attributes bound to all sub-types can be moved into their common super-type. Note however that the allowed values of a common attribute may be different for sibling sub-types.

Supplementary Information

+providedBy 0..*   0..*
+provides
+provides 0..*   0..*
+provides

UpdateInformation

+providedBy   +identifies
0..*   0..1

Feature Association: updatedInformation

Information Association: additionalInformation

+updates   1

UpdatedFeatures

UpdatedFeatures::TextPlacement

+identifies
0..1

Feature Association: textAssociation

+providedBy   0..*

UpdatedFeatures::Metadata Features
DataCoverage etc.

UpdatedFeatures::InformedFeatures

+positions   1

UpdatedFeatures::InformedFeatures::AllGeoFeatures

UpdatedFeatures::InformedFeatures::AllGeoFeatures::StructureFeatures

«subType»
+ Building
+ Crane
+ FloatingDock
+ FortifiedStructure
+ FishingFacility
+ Hulk
+ MooringWarpingFacility
+ OffshorePlatform
+ Pontoon
+ PylonBridgeSupport
+ Obstruction
+ ShorelineConstruction
+ SiloTank
+ Wreck
+ Bridge
+ OffshoreWindTurbine

+supportedBy   +supports
1   0..*

Feature Association: structureEquipment

+consistsOf
0..*

UpdatedFeatures::InformedFeatures::AllGeoFeatures::EquipmentFeatures

«subType»
+ FogSignal
+ LightAirObstruction
+ LightFogDetector
+ PhysicalAISAidToNavigation
+ RadarTransponderBeacon
+ Retroreflector
+ SignalStationTraffic
+ SignalStationWarning
+ RadarStation
+ RadioStation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::EquipmentFeatures::LightAllAround, LightSectored

+supportedBy   1

UpdatedFeatures::InformedFeatures::AllGeoFeatures::LandArea

+consistsOf   +componentOf

2..*   0..1

Feature Association: islandAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::IslandGroup

UpdatedFeatures::InformedFeatures::AllGeoFeatures::PilotBoardingPlace

+provides   +boardingLocation
0..1

Feature Association: districtBoardingLocations

UpdatedFeatures::InformedFeatures::AllGeoFeatures::PilotageDistrict

+supports
0..*

Feature Association: structureEquipment

UpdatedFeatures::InformedFeatures::AllGeoFeatures::AnchorageArea and other features

UpdatedFeatures::InformedFeatures::AllGeoFeatures::StructureFeatures::NavigationalAidsFeatures

«subType»
+ BeaconCardinal
+ BeaconIsolatedDanger
+ BeaconLateral
+ BeaconSafeWater
+ BeaconSpecialPurposeGeneral
+ BuoyCardinal
+ BuoyEmergencyWreckMarking
+ BuoyInstallation
+ BuoyIsolatedDanger
+ BuoyLateral
+ BuoySafeWater
+ BuoySpecialPurposeGeneral
+ Landmark
+ LightFloat
+ LightVessel
+ Pile
+ Daymark

The Daymark feature type can be aggregated with other structure feature as the Equipment feature by used of the "structureEquipment" composition.

+componentOf   0..1

Feature Association: bridgeAssociation

+componentOf
1

UpdatedFeatures::InformedFeatures::AllGeoFeatures::StructureFeatures::Bridge

+componentOf   +consistsOf
0..*

Feature Association: bridgeAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::SpanFixed, SpanOpening, PylonBridgeSupport

+componentOf
0..1

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures::DeepWaterRoute

+componentOf   +consistsOf
0..1   2..*

Feature Association: deepWaterRouteAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures::DeepWaterRoutePart, DeepWaterRouteCentreline

+componentOf
0..1

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures::TwoWayRoute

+componentOf   +consistsOf
0..1   2..*

Feature Association: two-wayRouteAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures::TwoWayRoutePart

+consistsOf   +componentOf
0..*   0..1

+componentOf
0..1

UpdatedFeatures::InformedFeatures::AllGeoFeatures::ArchipelagicSeaLane

+componentOf   +consistsOf
0..1   2..*

Feature Association: ASLAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::ArchipelagicSeaLaneArea, ArchipelagicSeaLaneAxis

+componentOf
0..1

Feature Association: aidsToNavigationAssociation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures

«subType»
+ CautionArea
+ DeepWaterRouteCentreline
+ DeepWaterRoutePart
+ InshoreTrafficZone
+ PrecautionaryArea
+ RestrictedArea
+ TrafficSeparationLine
+ TrafficSeparationSchemeBoundary
+ TrafficSeparationSchemeCrossing
+ TrafficSeparationSchemeLanePart
+ TrafficSeparationSchemeRoundabout
+ TrafficSeparationZone
+ DeepWaterRoute
+ TrafficSeparationScheme
+ Two-WayRoute
+ TwoWayRoutePart

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures::CautionArea

+consistsOf
0..*

Feature Association: cautionAreaAssociation

+consistsOf 2..*

+componentOf   +componentOf
0..1

UpdatedFeatures::InformedFeatures::AllGeoFeatures::RangeSystems

+componentOf   +consistsOf
0..1   2..*

Feature Association: RangeSystemAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::NavigationLine, RecommendedTrack, RecommendedRouteCentreline

+consistsOf
2..*

Feature Association: RangeSystemAggregation

+consistsOf
0..*

+componentOf
0..1

Feature Association: trafficSeparationSchemeAggregation

UpdatedFeatures::InformedFeatures::AllGeoFeatures::TSSchemesFeatures::TrafficSeparationScheme

+componentOf   +consistsOf
0..1   2..*

Feature Association: trafficSeparationSchemeAggregation

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Table 1. Proposed super-types

Class Name	Description	Super-type
UpdatedFeatures	Super-type for all ENC features which can be updated	none
InformedFeatures	Super-type for all features which can have an information type associated with them in an ENC dataset.	UpdatedFeatures
AllGeoFeatures	Abstract super-type for all geographic features in an S-101 ENC	InformedFeatures
EquipmentFeatures	Abstract super-type for all equipment features	AllGeoFeatures
StructureFeatures	Abstract super-type for all Structure features	AllGeoFeatures
NavigationalAidsFeatures	Abstract super-type for structure features which are also part of navigation aids	StructureFeatures
TSSchemesFeatures	Abstract super-type for traffic separation scheme features	AllGeoFeatures

The structure/equipment associations incorporate amendments to the DCEG being proposed in a separate submission to this meeting. They also reflect our understanding of the DCEG statement in 17.2 that when a structure feature is unknown or unavailable, "one of the equipment features may be chosen as the structure feature, giving priority to a Light feature, if one exists."

Metadata features are tentatively sub-types of **UpdatedFeatures**, since the DCEG says **Supplementary Information** encodes information which applies to one or more GEO Features.

Since the DCEG says that text placement applies to all geo features, **InformedFeatures** has only one sub-type (**AllGeoFeatures**). If geo features which cannot have text placement are identified based on portrayal, they would hypothetically be sub-types of **InformedFeatures**.

The proposed type hierarchy is intended to conform to the April 2014 baseline draft of the S-101 DCEG which was available when the hierarchy was developed, but since the DCEG baseline may undergo further changes, finalization of the type hierarchy should be coordinated with changes to the DCEG.

Detailed documentation of the abstract types should not be needed in the DCEG, provided all inherited associations and attributes are replicated in descriptions of the concrete sub-types. This would already be the case for the current draft since it was developed without a type hierarchy. Since the abstract types appear in feature catalogues, a summary diagram and definitions might be included.

3   Recommendations

Develop a type hierarchy for S-101 features and incorporate it into the application schema and feature catalogue, and update the S-101 product specification and the DCEG accordingly.

4   Impacts

Modifications will be needed to the draft S-101 XML feature catalogue. If and when a full application schema for S-101 is prepared, the type hierarchy must be incorporated into the application schema as well.

Maintenance of product specification, DCEG, and feature catalogue must consider the side-effects of any updates to the properties or associations of upper-level types.

5   Actions Requested

The S-101 PT is invited to:-

- review the proposed type hierarchy and modify it as appropriate, taking into consideration pending updates to the S-101 DCEG;

- take all necessary steps to incorporate the result into the XML feature catalogue;

- take all necessary steps to document the result in the product specification and DCEG.