Paper for Consideration by the S-100 TSM

Issues with the Part 9-7 Data Input Schema

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Executive Summary:	Identifies issues and recommends changes to the Part 9-7 Data Input Schema
Related Documents:	S-100 Part 9
Related Projects:	Development of S-100 and S-1XX product specifications

1   Introduction / Background

S-100 provides a portrayal framework defining capabilities for use by products. The framework ensures product presentation, use, and implementation in a standard, consistent manner.

Currently the Part 9-7 data input schema used with XSLT portrayal rules cannot be used in a standard, consistent manner. This paper makes four recommendations related to the data input schema:

- Form a group to investigate modifications of the data input schema in support of machine readability
- Update the spatial model to conform to the general feature model
- Provide concrete spatial types
- Form a group to investigate data input schema inefficiencies

These enhancements will enable consistent implementation and use of the data input schema, in support of machine readability.

2   Issues with the Part 9-7 Data Input Schema

S-100 provides two types of portrayal rule processing: XSLT and Lua. XSLT rules transform data encoded per the 9-7 data input schema into drawing instructions. Lua rules do not use the data input schema; the following issues do not apply to Part 9a.

Currently, products that use XSLT must extend the data input schema. The 9-7.7 spatial, 9-7.8 information, and 9-7.9 feature object types are abstract, and therefore must be extended by product specifications that use XSLT. Note also 9-7.1 paragraph two (emphasis added):

> *[…] In this standard only the base types are described. The actual feature types of a data product **must be specified in a schema** that will be **part of the product specification**.*

The requirement to extend the data input schema has several drawbacks:

- Complicates product specification development. A data input schema must be developed, duplicating the information provided in the encoding guide and feature catalogue.
- Complicates product maintenance. The data input schema must be kept in alignment with changes to the DCEG and feature catalogue.
- Increases application development time. Product-specific code must be developed to produce the input data conforming to each products input schema.
- Does not support machine-readability. While the feature catalogue can be updated, there is no mechanism to deliver an updated data input schema.
- Requires application software updates for changes to any of the product-specific input schemas.

We recommend forming a group to investigate modifications of the data input schema in support of machine readability *[Recommendation 1]*. These changes should aim to reduce the burden placed on product specification and application developers.

2.1 Data Input Spatial Schema

2.1.1 Spatial Quality

The input schema does not provide for the association of spatial objects to information objects. This is in contrast to the general feature model; note 3-6.5.3:

> *The positional quality of a spatial object shall be described by a one-way association to a S100_GF_InformationType which is associated with a S100_GF_SimpleAttribute carrying positional accuracy.*

This oversight requires products to extend the spatial model of the data input schema when they wish to provide spatial quality. It is likely that products will extend the schema in incompatible ways, requiring multiple code paths within an application to handle the various extensions. Note further that the feature catalogue cannot describe product specific changes to the spatial schema.

We recommend updating the spatial model of the data input schema to conform to the general feature model *[Recommendation 2]* by:

- Adding abstract class *SpatialObject* as an extension of 9-7.6 *Object*
    - Use as the base class for all 9-7.7 spatial objects
- Provide a one-way association from *SpatialObject* to *Information*
    - Supports spatial quality (see 3-6.5.3)

These recommendations align the spatial model of the input schema with the general feature model, as reflected in the following update to Figure 9-8:
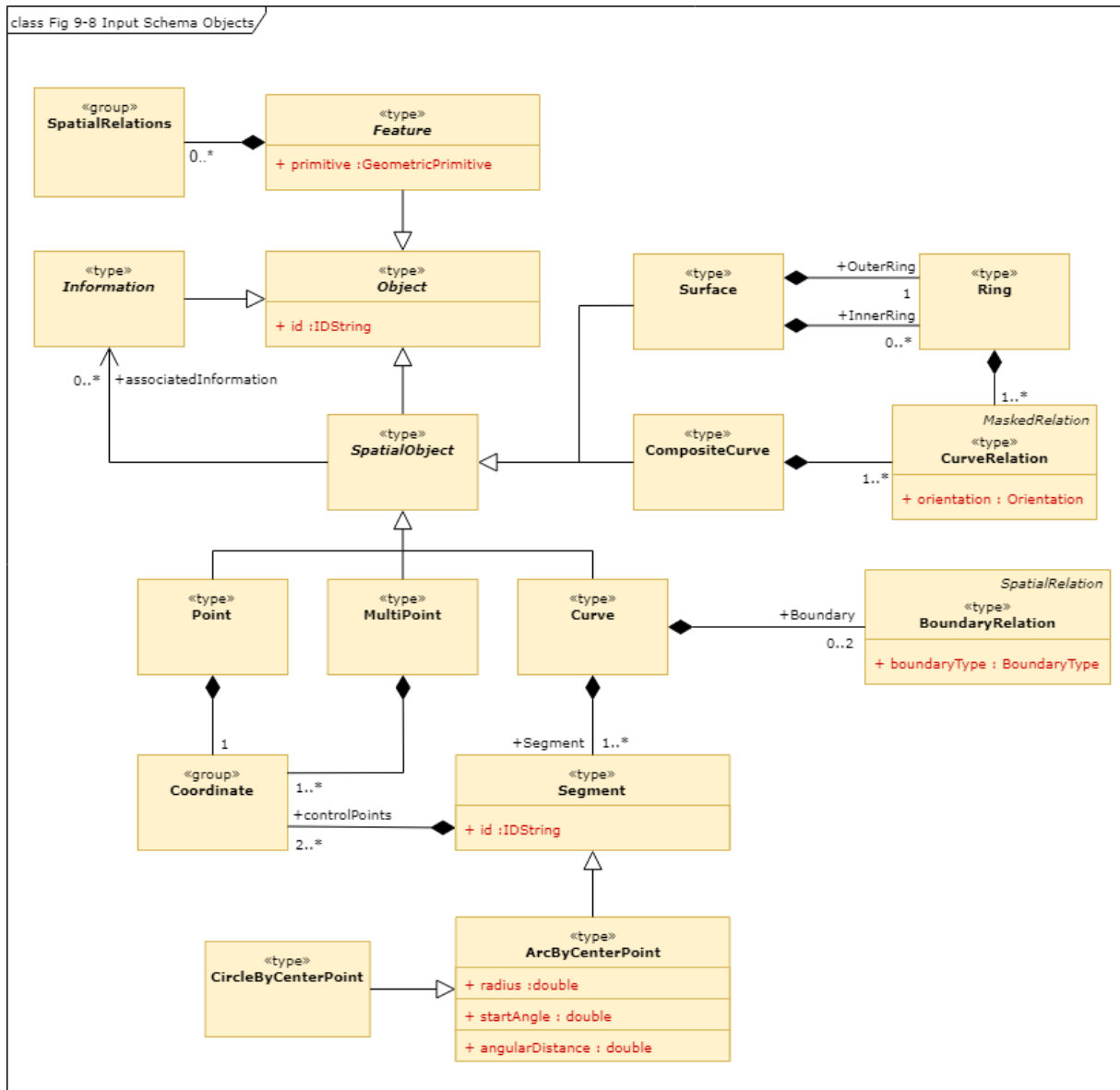
Figure 1 - Input Schema Objects

Information, including spatial quality, is made available to the portrayal rules in a consistent manner via the *associatedInformation* attribute of each spatial object.

2.1.2   Spatial Objects

All products should use a consistent spatial model – the Part 7 profile of ISO 19107. A product should not extend the spatial model; rather Part 7 itself should be extended to meet future requirements as described in 7-1:

> *The spatial requirements of S-100 are less comprehensive than the requirements of ISO 19107 "Geographical Information - Spatial schema" which contains all the information necessary for describing and manipulating the spatial characteristics of geographical features and on which this Part is based. Hence this Part contains only the subset of ISO 19107 classes required for S-100. This version only contains geometry, if there is a future requirement for topology then this Part will be extended to meet these requirements.*

Note also 3-6.5.1 General spatial rules:

> *The value domain of spatial attribute types shall be in accordance with the specifications given by S-100 Part 7, which provides conceptual schemas for describing the spatial characteristics of features and a set of spatial operators consistent with these schemas.*

Furthermore, there is no provision for describing changes to the spatial schema using the feature catalogue.

Despite the preceding points, spatial objects in the data input schema must be extended by each product specification. Each 9-7.7 spatial object type is abstract, and therefore products must provide a concrete class to realize these objects. The primary use case supporting this design is to provide spatial quality. Given the changes proposed in 2.1.1 Spatial Quality, products will not need to extend the schema to support spatial quality.

We recommend providing concrete spatial object types in 9-7.7, rather than abstract types *[Recommendation 3]*. There is no need to extend the spatial objects. The recommended changes are shown in Figure 1 - Input Schema Objects.

2.2   Data Input Schema Inefficiencies

Currently, the entire dataset contents (excluding Coverage spatial objects) must be provided to the portrayal processing. An application has no way to know which elements of a dataset will be processed by the portrayal rules; this is in contrast to the Part 9a portrayal, which requests only the elements needed during portrayal processing.

Most data within a dataset is not processed by portrayal, as it does not affect the output drawing instructions. This disconnect between the data used by portrayal, and the requirement to provide all data, results in inefficiencies in terms of processor and memory usage. The majority of these inefficiencies are driven by the presence of unprocessed spatial objects.

In order to correct these inefficiencies, we recommend a group investigate the addition of a means to describe the data elements used by the rules present in a given portrayal catalogue. Notionally, a list of feature catalogue and spatial elements to be included and / or excluded from the portrayal *[Recommendation 4]*.

3   Action Required

The group is invited to:

    a.   Note the issues presented

    b.   Determine action for recommendation 1

    c.   Determine action for recommendation 2

    d.   Determine action for recommendation 3

    e.   Determine action for recommendation 4