

Paper for Consideration by TSMAD 29 Clarification of the Various Scale Values in S-101

Submitted by:	United States (SPAWAR Atlantic)
Executive Summary:	Proposed changes to S-101 to remove ambiguity in the defined scale values
Related Documents:	S-101 Draft (July 2014)
Related Projects:	S-100 Draft 2.0.0 (January 2015)

Type of Change Requested:

As the current specification stands, there is significant ambiguity in the definition and uses of the various scale values defined in S-101. This document attempts to summarize those ambiguities, as well as propose some changes to the specification in an attempt to address the indicated ambiguities.

Scale Value Ambiguity Issues with the S-101 Draft July 2014 version:

S-101 defines the following scale values:

- *maximumDisplayScale*, as an attribute of DataSetMetadata, which is part of the exchange set (see S-101 12.1.1)
- *maximumDisplayScale* and *minimumDisplayScale*, attributes of S101_DataCoverage, which is part of the exchange set (see S-101 12.1.1.1)
- *scaleMinimum*, as an attribute of SpatialRelation (defined in S-100 9-8.5)

In addition, there are a few other scale values that are defined in S-100, for which S-101 does not explicitly indicate allowable usage:

- SpatialRelation defines a *scaleMaximum*.
- S100_DatasetDiscoveryMetaData defines a *minimumDisplayScale*. S-101 does contain a diagram (12.1 Fig. 21) that shows a similar S101_DatasetDiscoveryMetaData, but it unclear if this derives from S100_DatasetDiscoveryMetaData, or if this is the same as the DataSetMetadata defined in 12.1.1.

S-101 also enumerates a set (listed below in no particular order) of constraints based upon these scale values:

- If the Mariner Selected Viewing Scale (MSVS) is smaller than a feature's *scaleMinimum*, do not display the feature. (see S-101 C9.9.2)
- If the MSVS is smaller than the DataCoverage's *minimumDisplayScale*, then do not display the associated skin of the earth features. (See S-101 4.6)
- If the MSVS is smaller than a DataCoverage's *minimumDisplayScale*, then the associated features are not "loaded" (and therefore not displayed). (See S-101 4.7)
- When a dataset has multiple DataCoverages, the *minimumDisplayScale* for all of the DataCoverages must be the same value. (See S-101 4.5.3)
- When the MSVS is larger than a DataCoverage's *maximumDisplayScale*, an overscale indication must be shown over skin of the earth features which cover the given DataCoverage. (see S-101 4.6)
 - Note: It should be "overscale pattern", not "overscale indication". This is addressed in the comment form submitted by US(SPAWAR).
- Dataset with the same *maximumDisplayScale* may overlap. (see S-101 4.5.3)
- DataCoverages within a dataset must not overlap. (see S-101 4.5.3) Note: The language is ambiguous as to whether this rule applies to DataCoverages with the same *maximumDisplayScale* or all DataCoverages regardless of *maximumDisplayScale*.
- DataCoverages with the same *maximumDisplayScale* must not overlap when multiple producers are involved. (see S-101 4.5.3) Note: The language is ambiguous as to whether this also applies to multiple datasets produced by a single producer.

Given the above information, this leaves us with the following issues and/or questions:

- Can a SpatialRelation contain *scaleMaximum* value in S-101, and if so, how should it be treated?
- What is the relationship, if any, of the *maximumDisplayScale* values for multiple DataCoverages in the same dataset?
- What is the relationship of the DataCoverage *maximumDisplayScale* and the DatasetMetadata *maximumDisplayScale*?
- What scale, for any given coverage, is considered to be the “preferred” scale? In other words, when a mariner desires to show data “at scale”, what value should the scale be set to?
- Since all of *minimumDisplayScale* values must be the same for all DataCoverages in a dataset, should this attribute be moved to DataSet instead?
- S-101 C9.3.6.2.1 indicates that the “overscale indication is required by IMO PS [3] whenever the display scale exceeds the compilation scale”. Similar requirements based on compilation scale exist for display of the overscale factor and the overscale pattern. However, the DCEG explicitly states that compilation scale is not encoded. This would infer, based on the other sections in S-101, that the DataCoverage *maximumDisplayScale* is to be treated as the compilation scale. However, as the allowable values of *maximumDisplayScale* are limited to those values listed in S-101 3 (Spatial Resolution), there are two non-ideal conditions which result:
 - A *maximumDisplayScale* is selected to be the nearest value greater than the compilation scale: this is the safest option, but will prematurely cause overscale indication, display of overscale pattern, and distort the value of the overscale factor.
 - A *maximumDisplayScale* is selected to be the nearest value less than the compilation scale: this ensures that overscale is not prematurely indicated, but it also means that overscale is no longer indicated based on the original compilation scale. Overscale pattern is similarly affected, and the overscale factor is distorted.

Proposed changes/updates to the S-101 Draft July 2014 version:

Without having the benefit of knowledge of the intent of the original writer(s) of these rules, it is somewhat difficult to make a recommendation that is guaranteed to be consistent with that intent. With that disclaimer in mind, the following recommendations are made:

- Remove the *maximumDisplayScale* from DatasetMetadata:
 - If this attribute is actually supposed to be the attribute mentioned in S101_DatasetDiscoveryMetaData, it could instead be left as an empty value.
 - Since *maximumDisplayScale* is only used for overscale indication and portrayal of scale boundaries and patterns, it should only be an attribute of the DataCoverage (where those portrayal rules are defined).
 - Use the SpatialRelation *scaleMaximum* attribute for each DataCoverage to indicate when the overscale pattern should be portrayed. All other features in S-101 would leave *scaleMaximum* empty. This would bring the specification in alignment with DCEG 3.4.1.
- Add a restriction to DataCoverages within the same DataSet which disallows them to overlap (regardless of *maximumDisplayScale*). This ensures that all feature spatials within the dataset are unambiguously associated to a single DataCoverage. This would bring the specification in alignment with DCEG 3.4.1.
- Move the DataCoverage *minimumDisplayScale* to be an attribute of the DatasetMetadata.
 - If DatasetMetadata is the same as S101_DatasetDiscoveryMetaData, then this is already accounted for.
 - Since all DataCoverages within a dataset must have the same *minimumDisplayScale*, there is no need to record them separately for each DataCoverage. As a result, the DataCoverage’s SpatialRelation *scaleMinimum* can be left empty. Once the Viewing Scale has been set to a smaller scale than the DatasetMetadata’s *minimumDisplayScale*, the entire dataset is unloaded, so the DataCoverages in the dataset aren’t evaluated for portrayal.

Allowing for the above recommendations, the following elements of the specification are also simplified:

- No data within a DataSet is loaded if the MSVS is smaller than the DatasetMetadata’s *minimumDisplayScale*.
- There is no need to sort features (based on *maximumDisplayScale*) within the same dataset since DataCoverages do not overlap. As a result, none of the skin of the earth features within the dataset overlap either.
- When portraying multiple datasets, the sorting rules detailed in S-101 4.7 are applied to all DataCoverages across the datasets. Because DataCoverages within the same dataset do not overlap and DataCoverages with the same *maximumDisplayScale* across all DataSets do not overlap, an unambiguous sort of the features can be obtained.
- For portrayal, a feature that exists in multiple datasets will portray with the related DataCoverage that has the largest *scaleMaximum*.

- For portrayal, a feature is not displayed if it is fully obscured by a visible DataCoverage which:
 - The feature does not belong to (i.e. is not in the same dataset as that DataCoverage), and
 - The DataCoverage's *scaleMaximum* is larger than the *maximumDisplayScale* of any of the DataCoverages that the feature belongs to.

It should be noted that a rewrite of all the appropriate sections of the S-101 specification cannot be realistically provided as a part of this proposal, as those changes are widespread and substantial. Should the TSMAD accept this proposal, SPAWAR Atlantic is offering to comprehensively update the scale value language in the revised version of S-101 Draft that emerges out of the TSMAD 29.

Justification for the proposed changes:

Approval of the proposed changes would remove all ambiguity in scale value definitions in the S-101 standard, as well as provide maximized consistency with the S-100 Universal Hydrographic Data Model definitions and terminology.

The TSMAD is invited to consider the issues presented above and approve. Approval includes the United States (SPAWAR Atlantic) comprehensively updating the scale value language in the revised version of S-101 that emerges out of the TSMAD 29.