Paper for Consideration by the S-100 TSM

Validation of Portrayal Inputs

Submitted by:	NIWC Atlantic
Executive Summary:	Proposes changes supporting validation of context parameter values provided to S-100 portrayal rules
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.

This paper recommends enhancements supporting the validation of inputs to the S-100 portrayal rules.

2   Validation of Portrayal Inputs

The primary mechanism in the portrayal model for modifying the portrayal output is via changes to context parameters. A portrayal catalogue can define context parameters as desired, each of which controls some aspect of the portrayal output.

Best practices call for performing data validation prior to processing data inputs, to prevent the processing of improperly formed data. The portrayal could produce unexpected results due to the intentional or unintentional input of improperly formed data.

For proper validation, it is important to identify the form and type of data that is expected. While the portrayal catalogue requires the type of context parameters to be described using 9-13.3.23 *ParameterType*, it does not provide a mechanism to describe the form of expected values. Thus, the data validation an application can perform is limited to ensuring the input data conforms to the expected data type.

To fully support data validation, we recommend extending the portrayal catalogue model to allow constraints to be applied to context parameters. Constraints for each of the context parameter types should be modelled:

- boolean
- integer
- double
- string
- date

The ideal constraint is to eliminate free-form data input. This can be accomplished by restricting the valid inputs for a given context parameter to an enumeration. In order to provide context for the enumerated value we recommend providing a language-independent label to be displayed by an applications user interface.

For instance, a boolean type may have an enumeration constraint applied which labels "true" as "Enabled", and "false" as "Disabled", providing a user context for the selection of a parameter such as "Radar Overlay". A string type may have an enumeration constraint applied in order to provide alternate labels supporting different languages. Additional examples are shown in 2.2 Example Portrayal Catalogue Entries.

While enumerated values are always sufficient for constraining the boolean type, they are not always sufficient for constraining other types. It is not always possible to describe the expected input with a list of values, or the

number of values in the list may preclude doing so; therefore, a mechanism to describe an expected range and / or pattern for each type of data should be provided.

Class 2a-4.2.11 *S100_CD_AttributeConstraints* can describe the expected range and precision of numbers (integer or double), and the expected length and pattern of strings or numbers. There is no preexisting type to constrain dates, but *TimeInterval* as described in paper TSM7-5.4 can define valid intervals for this purpose.

Extending the portrayal catalogue model to allow enumerated values, *S100_CD_AttributeConstraints,* and *TimeIntervals* to be associated with a *ContextParameter* will enable applications to fully validate portrayal inputs, supporting best practices and minimizing the chance of unexpected portrayal input.

2.1   Recommended Changes to the Portrayal Catalogue Model

Context parameters are described in the portrayal catalogue via class 9-13.3.20 *ContextParameter*. Extending the class as follows supports the previously described constraint mechanisms. Proposed changes are highlighted in the tables below.

Note that *EnumerationDescription* is very similar to *Description*, the only difference being the multiplicity of the attributes. If the preferred, the multiplicity of *Description* attributes can be modified and *EnumerationDescription* can be replaced by *Description* in the model.
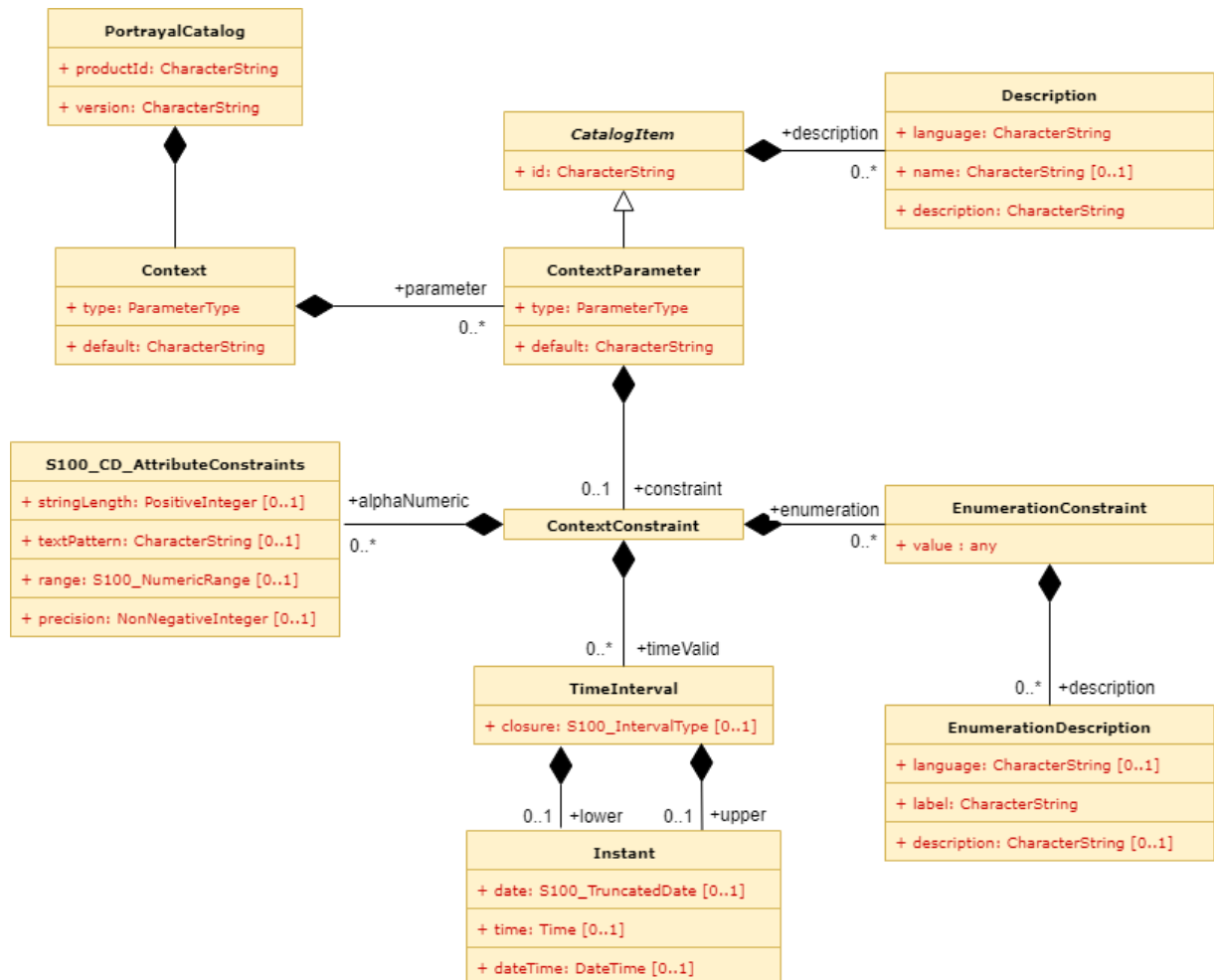
Role Name	Name	Description	Mult.	Type
Class	ContextParameter	A Context Parameter name and definition	-	-

Subtype of	CatalogItem	See CatalogItem	-	-
Attribute	type	The data type of the Parameter	1	ParameterType
Attribute	default	A default value for the Parameter	1	string
Association	constraint	Constrains the Parameter	0..1	ContextConstraint

Role Name	Name	Description	Mult.	Type
Class	ContextConstraint	Describes expected values	-	-
Association	alphaNumeric	Constrains string and numeric types	0..*	S100_CD_AttributeConstraints
Association	timeValid	Constrains date type	0..*	TimeInterval
Attribute	enumeration	Constrains to enumeration	0..*	EnumerationConstraint

Role Name	Name	Description	Mult.	Type
Class	EnumerationConstraint	An enumerated value constraint	-	-
Attribute	value	The value of the enumeration	1	any
Association	description	Describes the value	0..*	EnumerationDescription

Role Name	Name	Description	Mult.	Type
Class	EnumerationDescription	Describes an enumerated value constraint	-	-
Attribute	language	ISO 639-2/T alpha-3 code default is "eng"	0..1	string
Attribute	label	A label for presentation to the user. If present, shown on the UI instead of the value.	1	string
Attribute	description	Describes the value	0..1	string

Role Name	Name	Description	Mult.	Type
Class	TimeInterval	A time or time period Single value intervals are encoded with *upper* = *lower* and *closure* = *closedInterval* (or omitted)	-	-
Attribute	closure	Specifies an *S100_IntervalType* Default is *closedInterval*	0..1	S100_IntervalType
Association	lower	Start of the interval	0..1	Instant
Association	upper	End of the interval	0..1	Instant

Role Name	Name	Description	Mult.	Type
Class	Instant	A point in time. Multiple points may be described via truncated dates used to represent recurring instants.	-	-
Attribute	date	An *S100_TruncatedDate* (see table 1-2)	0..1	S100_TruncatedDate
Attribute	time	A *Time* (see table 1-2)	0..1	Time
Attribute	dateTime	A *DateTime* (see table 1-2)	0..1	DateTime

2.2   Example Portrayal Catalogue Entries

2.2.1   Constrain string values by restricting the pattern and length of expected values

```
<context>

  <parameter id="1">
    <description>
      <name>NATIONAL_LANGUAGE</name>
      <description>Selects a language for text</description>
      <language>en</language>
    </description>
    <type>String</type>
    <default>eng</default>

    <constraint>
      <alphaNumeric stringLength="3" textPattern="[a-z]{3}"/>
    </constraint>

  </parameter>
</context>
```

2.2.2   Constrain string and boolean values using an enumeration

```
<context>

  <parameter id="1">
    ...
    <type>String</type>
    <default>East</default>

    <constraint>
      <enumeration value="North"/>
      <enumeration value="East"/>
      <enumeration value="South"/>
      <enumeration value="West"/>
    </constraint>

  </parameter>

  <parameter id="2">
    ...
    <type>Boolean</type>
    <default>True</default>
```

```xml
<constraint>
  <enumeration value="true">
    <description label="Enabled"/>
    <description label="활성화 돼있음" language="kor"/>
  </enumeration>
  <enumeration value="false">
    <description label="Disabled"/>
    <description label="비활성화 돼있음" language="kor"/>
  </enumeration>
  </enumeration>
</constraint>

  </parameter>
</context>
```

2.2.3   Constrain a date to 2019

```xml
<context>
  <parameter id="1">
    ...
    <type>Date</type>
    <constraint>
      <timeValid closure="geLtInterval">
        <lower date="20190101"/>
        <upper date="20200101"/>
      </timeValid>
    </constraint>
  </parameter>
</context>
```

2.3   Recommended Changes to the Portrayal Register Model

No changes are recommended. Context parameters are described in the registry via class 2b-4.2.25 *S100_PR_ContextParameter*. It is not necessary to extend the class to support the recommended portrayal catalogue changes.

The *S100_PR_ContextParameter* could be extended in the future to indicate the types of constraints that are allowed, or to constrain the constraints that can be provided. Although these changes could reduce the likelihood of user-error when building portrayal catalogues, they are outside the scope of this paper.

3   Action Required

The group is invited to:

     a.   Note the issues presented

     b.   Choose between

         a   Add *EnumerationDescription* (as shown)

         b   Change multiplicity of *Description* attributes (not shown)

     c.   Provide feedback and recommended way forward for presentation to S-100WG