

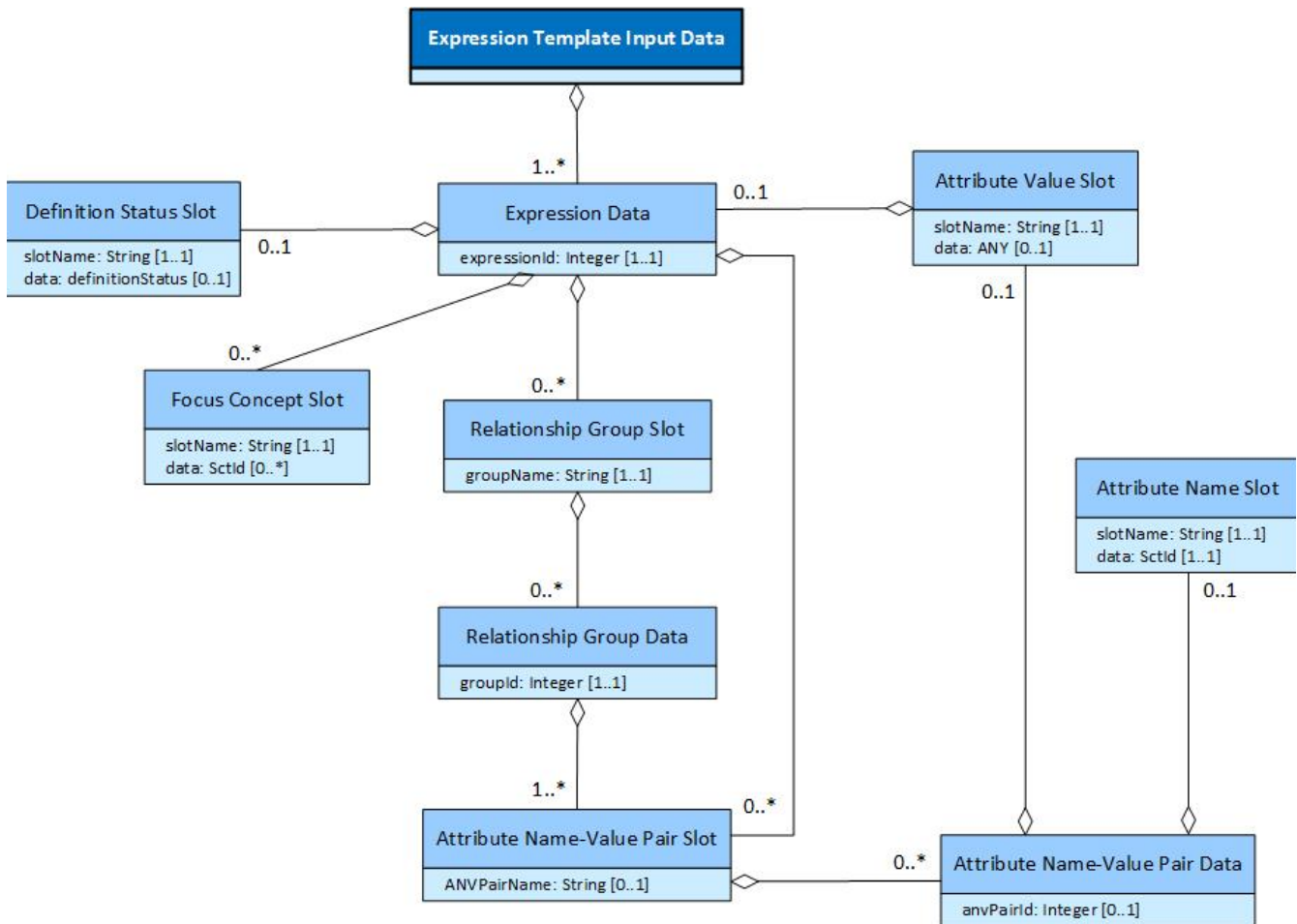
7.1. Preparing Input Data

Before a template can be processed, it is important that the input data is represented in a clear and unambiguous way. This is required to ensure that the template is processed in the expected manner, and the intended results are produced. In this section, we explain some of the considerations in representing and preparing the input data for processing.

Input Data Representation

Template input data may be represented in a variety of forms, ranging from flat tabular structures to nested serializations. Irrespective of the format, however, it is important that there is no ambiguity as to how each piece of input data should be used to create the resulting expressions. This can be particularly challenging where repetition of relationship groups or attribute name-value pairs is required.

The UML diagram below illustrates the logical structure of expression template input data. Each set of *Expression Template Input Data* includes the data intended to be used to create one or more expressions. The data used to populate a single expression is referred to in this model as *Expression Data*. Each *Expression Data* (identified by an expression id), may include at most one *Definition Status Slot* (with a slot name and a definitionStatus value), zero or more *Focus Concept Slots* (each with a slotName and zero or more values), zero or more *Relationship Group Slots* (each with a group name), and zero or more ungrouped *Attribute Name-Value Pair Slots* (each with a name). Each *Relationship Group Slot* has zero or more *Relationship Group Data* instances in the input data (each identified by a group id). Each of these *Relationship Group Data* instances has input data for one to many *Attribute Name-Value Pair Slots*. And for each *Attribute Name-Value Pair Slot* within a *Relationship Group Data* instance, there are zero to many *Attribute Name-Value Pair Data* instances (identified by an anvPair id), each with at most one *Attribute Name Slot* (with name and value), and at most one *Attribute Value Slot* (with name and either a simple data value, or an *Expression Data* instance of its own).



Unknown macro: 'caption-figure'

Input Data Examples

In this section, we provide some examples of unambiguous expression template input data, and discuss how this input data can be used to populate each expression.

Example 1

The expression template below is used to create expressions that represent a | Disease| with one or more | Finding site| and | Associated morphology|. When using expression templates, such as this one, in which attribute name-value pairs and relationship groups may be repeated, the input data should be explicit about which data values are used to populate each slot, and how these values are grouped into relationship groups.

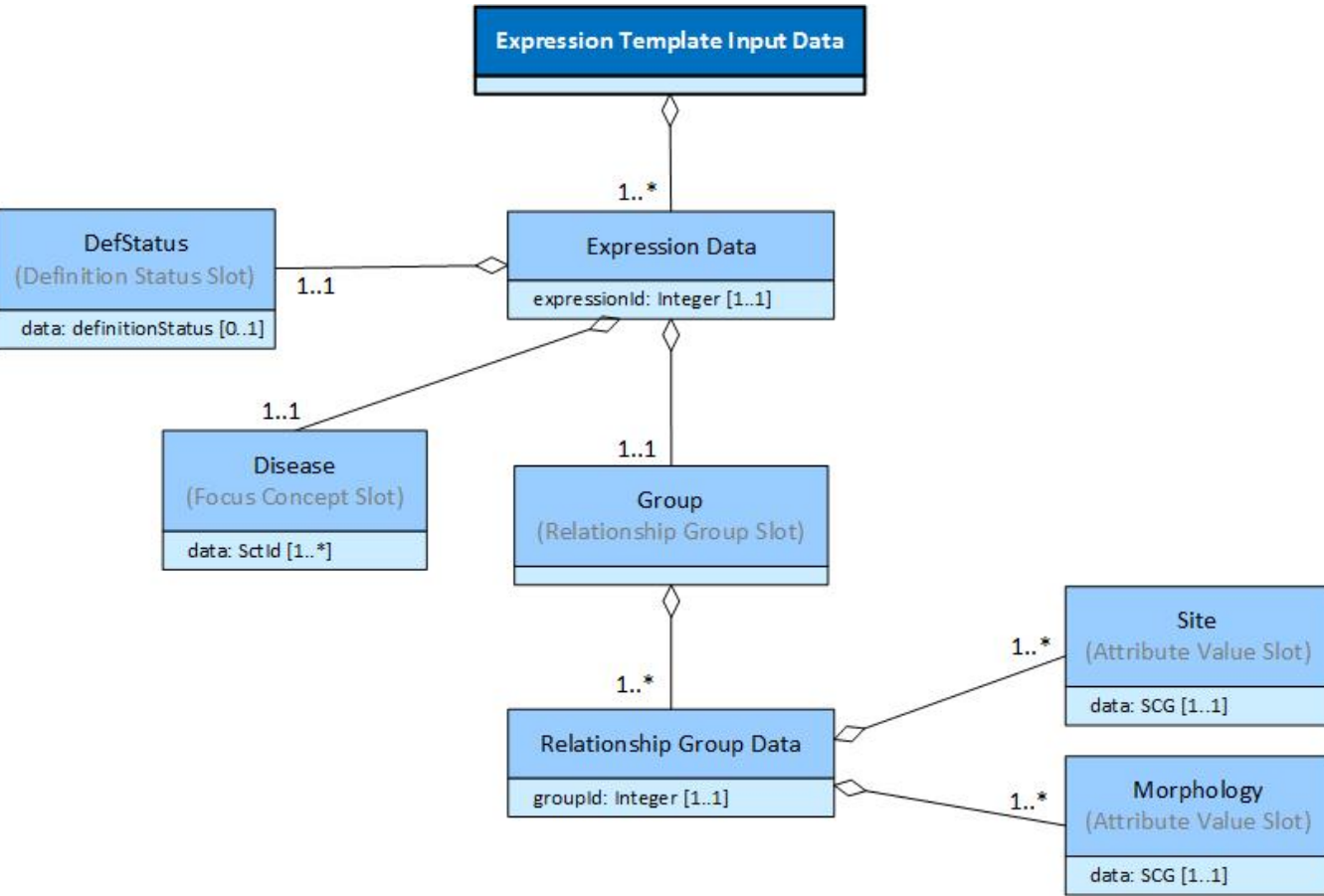
```
[[+tok (== <<<) @DefStatus]] [[+id (<< 64572001 |Disease| ) @Disease]] :  
  [[@Group]] { 363698007 |Finding site| = [[+ (<< 272673000 |Bone structure| ) @Site]],  
               116676008 |Associated morphology| = [[+ (<< 72704001 |Fracture| ) @Morphology]] }
```

Unknown macro: 'caption-ref'

To support the creation of input data for this expression template, the logical model in above can be specialized by replacing the 'Slot' classes (e.g. 'Relationship Group Slot' and 'Attribute Value Slot') with the name of the respective slots in the template, and simplifying where possible. The resulting logical model of input data for the above expression template is shown below in

Unknown macro: 'caption-ref'

. Please note that this model has been simplified by removing unnamed logical classes, which have a cardinality of 1..1 and no data attribute. For example, attribute name-value slots are not required in this example. In general, attribute name-value slots are only required where both the attribute name and the attribute value are represented using a slot.



Unknown macro: 'caption-figure'

Unknown macro: 'caption-ref'

By populating this logical model with input data, as shown below in , the expression template can be processed to generate completed expressions. Please note that the first column in the table below is used to group together the input data intended to populate each expression. Subsequent columns are named according to the associated slot in the expression template. Relationship group slots are used to group the data that is intended to populate a single relationship group. Attribute name-value slots are not required in this example. They are only required where both the attribute name and attribute value use a slot.

Unknown macro: 'caption-table'

Expression Data	DefStatus	Disease	Group	Site	Morphology
1	===	46866001 Fracture of lower limb	1	12611008 Bone structure of tibia	72704001 Fracture
2	<<<	92196005 Benign neoplasm of lung	1	39607008 Lung structure	3898006 Neoplasm, benign
		92038006 Benign neoplasm of bronchus	2	955009 Bronchial structure	3898006 Neoplasm, benign
3	<<<	60667009 Closed fracture of rib	1	113197003 Bone structure of rib	34305007 Fracture, multiple, closed
		36991002 Closed fracture of upper limb		371195002 Bone structure of upper limb	
4	===	16119006 Abscess of jaw	1	70925003 Bone structure of maxilla	44132006 Abscess
		109327001 Abscess of facial bone			
		128234004 Disorder of maxilla			

Unknown macro: 'caption-ref'

Using input data shown in expressions. to populate the given expression template will result in following four

Expression	
1	=== 46866001 Fracture of lower limb : { 363698007 Finding site = 12611008 Bone structure of tibia , 116676008 Associated morphology = 72704001 Fracture }
2	<<< 92196005 Benign neoplasm of lung + 92038006 Benign neoplasm of bronchus : { 363698007 Finding site = 39607008 Lung structure , 116676008 Associated morphology = 3898006 Neoplasm, benign }, { 363698007 Finding site = 955009 Bronchial structure , 116676008 Associated morphology = 3898006 Neoplasm, benign }
3	<<< 60667009 Closed fracture of rib + 36991002 Closed fracture of upper limb : { 363698007 Finding site = 113197003 Bone structure of rib , 363698007 Finding site = 371195002 Bone structure of upper limb , 116676008 Associated morphology = 34305007 Fracture, multiple, closed }
4	=== 16119006 Abscess of jaw + 109327001 Abscess of facial bone + 128234004 Disorder of maxilla : { 363698007 Finding site = 70925003 Bone structure of maxilla , 116676008 Associated morphology = 44132006 Abscess }

Example 2

The expression template below is used as a pattern for family history expressions. It contains a nested relationship group (i.e. SSgroup) inside the outer relationship group (i.e. AFgroup). To populate this expression template, the input data must be clear as to where each value should be used, and how these values should be grouped into relationship groups and expressions.

```

[[+id (<< 413350009 |Finding with explicit context| ) @Condition]]:
[[ 1..2 @AFgroup ]] { [[1..1]] 246090004 |Associated finding| = [[+id (<< 404684003 |Clinical finding| ) @Finding]]:
  [[0..1 @SSgroup]] { [[0..1]] 246112005 |Severity| = [[+id (< 272141005 |Severities| ) @Severity]],
    [[0..1]] 363698007 |Finding site| = [[+id (< 91723000 |Anatomical structure| ) @Site]] },
    [[1..1]] 408732007 |Subject relationship context| = [[+id (< 444148008 |Person in family of subject| ) @Relationship]],
    [[1..1]] 408731000 |Temporal context| = [[+id (< 410510008 |Temporal context value| ) @Time]],
    [[1..1]] 408729009 |Finding context| = [[+id (< 410514004 |Finding context value| ) @Context]] }

```

To support the creation of input data for this expression template, the logical model in

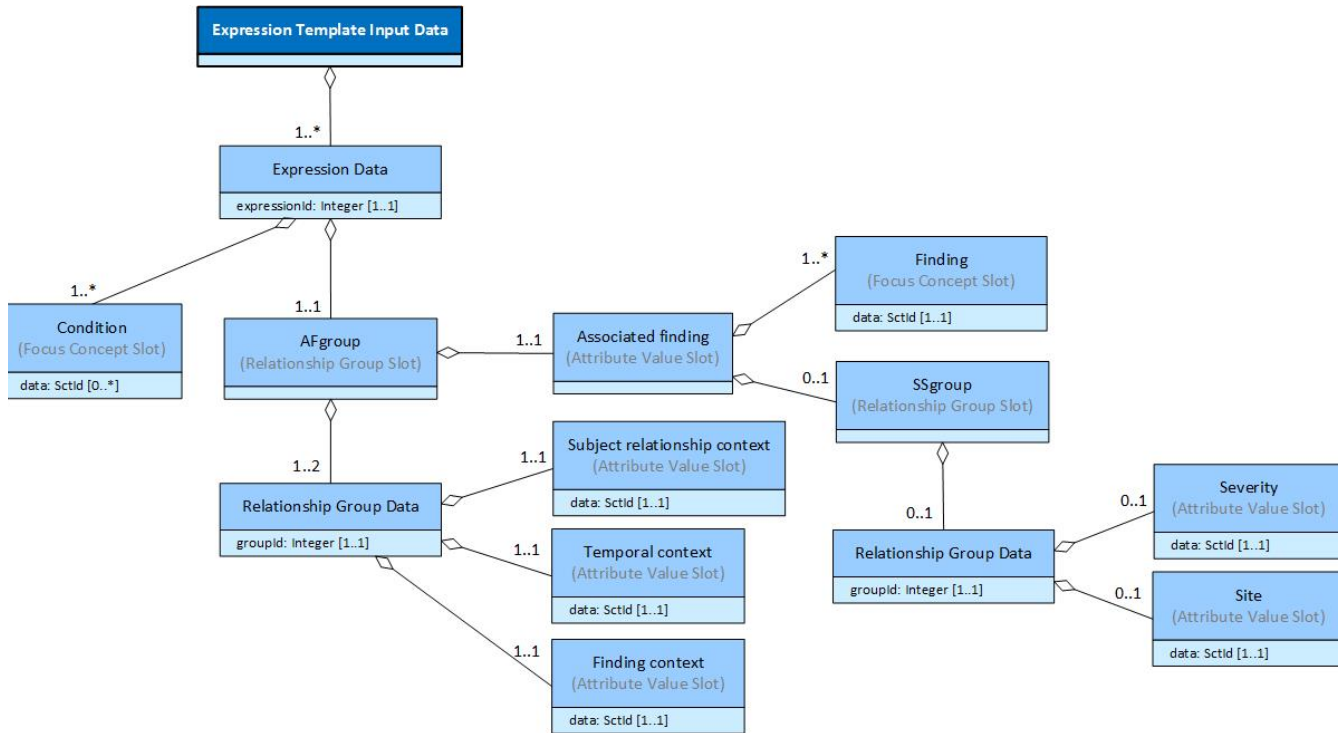
Unknown macro: 'caption-ref'

 above can

be specialized as shown below in

Unknown macro: 'caption-ref'

. Please note that this model has been simplified by removing unnamed logical classes, which have a cardinality of 1..1 and no data attribute.



Unknown macro: 'caption-figure'

This logical model can be populated with input data, as shown below in

Unknown macro: 'caption-ref'

.

Unknown macro: 'caption-table'

Expression Data	Condition	AFgroup	Finding	SSgroup	Severity	Site	Relationship	Time	Context
1	266898002 Family history: Respiratory disease	1	195967001 Asthma	1	24484000 Severe		444301002 Mother of subject	410589000 All times past	410515003 Known present
2	161077003 Father smokes	1	77176002 Smoker	1	255604002 Mild		444295003 Father of subject	15240007 Current	410515003 Known present

	161078008 Mother smokes	2	77176002 Smoker	1	24484000 Severe		444301002 Mother of subject	15240007 Current	410515003 Known present
3	160288009 Family history: neoplasm of skin	1	372130007 Malignant neoplasm of skin	1	6736007 Moderate	113179006 Skin structure of nose	444304005 Sister of subject	410511007 Current or past (actual)	410515003 Known present
	275937001 Family history of cancer			2	255604002 Mild	88089004 Skin structure of lip			

Using the input data shown above to process the given expression template will result in following three expressions.

Expression	
1	266898002 Family history: Respiratory disease : { 246090004 Associated finding = (195967001 Asthma : { 246112005 Severity = 24484000 Severe }), 408732007 Subject relationship context = 444301002 Mother of subject , 408731000 Temporal context = 410511007 Current or past (actual) , 408729009 Finding context = 410515003 Known present }
2	161077003 Father smokes + 161078008 Mother smokes : { 246090004 Associated finding = (77176002 Smoker : { 246112005 Severity = 24484000 Severe }), 408732007 Subject relationship context = 444295003 Father of subject , 408731000 Temporal context = 15240007 Current , 408729009 Finding context = 410515003 Known present } , { 246090004 Associated finding = (77176002 Smoker : { 246112005 Severity = 255604002 Mild }), 408732007 Subject relationship context = 444301002 Mother of subject , 408731000 Temporal context = 15240007 Current , 408729009 Finding context = 410515003 Known present }
3	160288009 Family history: neoplasm of skin + 275937001 Family history of cancer : { 246090004 Associated finding = (372130007 Malignant neoplasm of skin : { 246112005 Severity = 6736007 Moderate , 363698007 Finding site = 113179006 Skin structure of nose } , { 246112005 Severity = 255604002 Mild , 363698007 Finding site = 88089004 Skin structure of lip }), 408732007 Subject relationship context = 444304005 Sister of subject , 408731000 Temporal context = 410511007 Current or past (actual) , 408729009 Finding context = 410515003 Known present }

Example 3

The expression template below represents a procedure with a single method and one or more procedure devices. Please note that in the first attribute name-value pair, both the attribute name and the attribute value use a slot. Because this name-value pair is repeatable, the input data needs to include an attribute name-value pair slot to ensure that the corresponding attribute name and attribute value stays connected.

```
[[+id (<< 71388002 |Procedure| ) @Procedure]]:
[[1..1 @Group]]
{ [[1..* @PD_ANVpair]] [[+id (< 405815000 |Procedure device| ) @DeviceType]] = [[+ (< 260787004 |Physical object| ) @Device]],
[[1..1]] 260686004 |Method| = [[+ (< 129264002 |Action (qualifier value)| ) @Method]] }
```

To support the creation of input data for this expression template, the logical model in

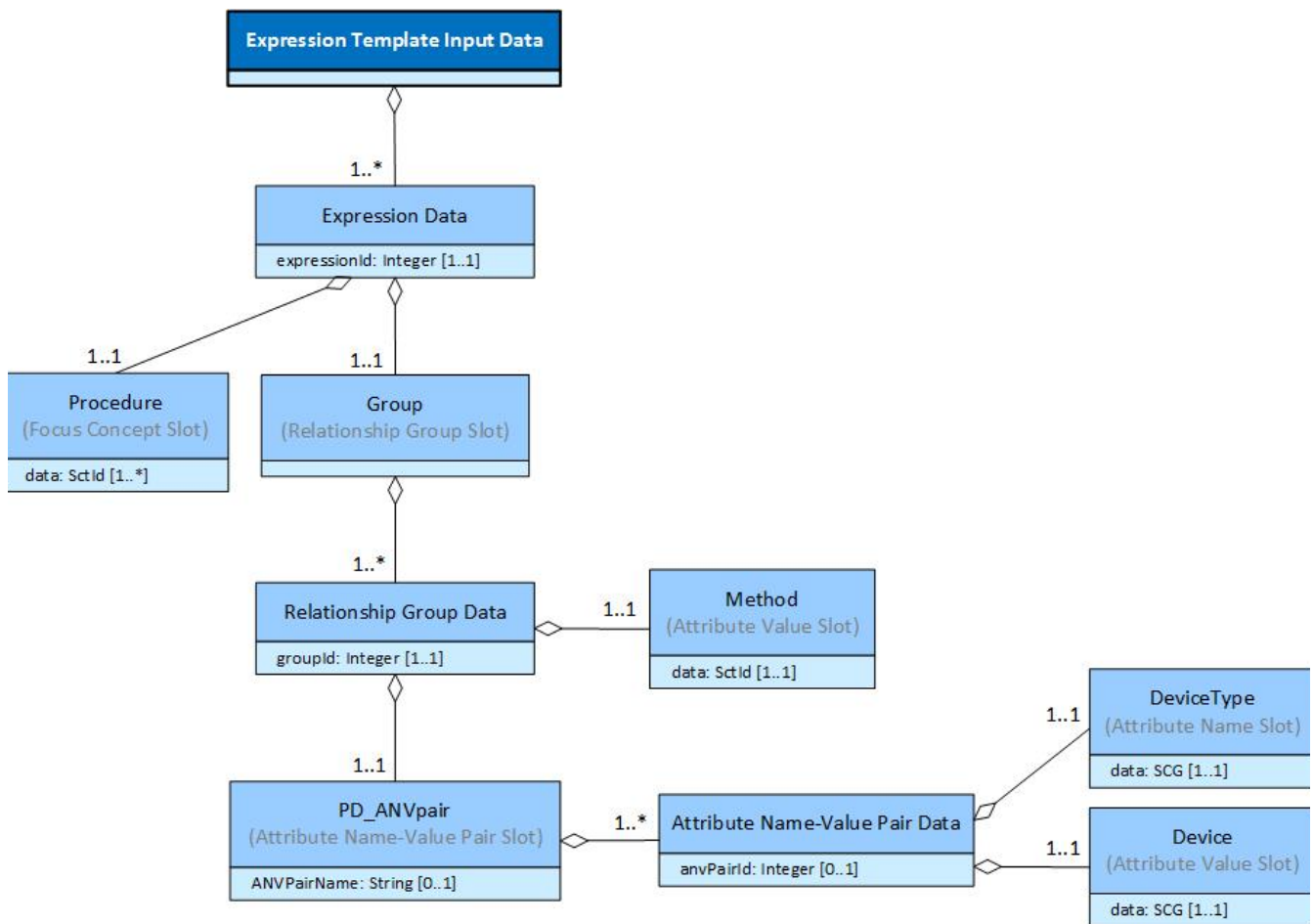
 Unknown macro: 'caption-ref'

above can

be specialized as shown below in

 Unknown macro: 'caption-ref'

. Please note that this model has been simplified by removing unnamed logical classes, which have a cardinality of 1..1 and no data attribute.



Unknown macro: 'caption-figure'

Unknown macro: 'caption-ref'

This logical model can be populated with input data, as shown below in [Table 1](#). Please note that because the first attribute name-value pair is repeatable and uses a replacement slot for both the attribute name and attribute value, the input data needs to include the attribute name-value pair slot to ensure that the corresponding attribute name and attribute value stays connected.

Unknown macro: 'caption-table'

Expression Data	Procedure	Group	PD_ANVpair	DeviceType	Device	Method
1	387713003 Surgical procedure	1	1	363699004 Direct device	2282003 Breast prosthesis, device	257867005 Insertion - action
2	71388002 Procedure	1	1	363699004 Direct device	313025003 Hearing aid battery	282089006 Replacement - action
			2	363710007 Indirect device	6012004 Hearing aid, device	

Unknown macro: 'caption-ref'

Using the input data shown in [Table 1](#) to process the given expression template will result in the following two expressions.

Expression	
1	387713003 Surgical procedure : { 363699004 Direct device = 2282003 Breast prosthesis, device , 260686004 Method = 257867005 Insertion - action }
2	384728007 Replacement of device : { 363699004 Direct device = 313025003 Hearing aid battery , 363710007 Indirect device = 6012004 Hearing aid, device , 260686004 Method = 282089006 Replacement - action }

Example 4

The expression template below represents a |Disease| with one or more values for |Finding site| and |Associated morphology| , grouped into one or more relationship groups.

64572001 Disease :
[[@Group]] { 363698007 Finding site = [[+ (<< 272673000 Bone structure) @Site]], 116676008 Associated morphology = [[+ (<< 72704001 Fracture) @Morphology]] }

To support the creation of input data for this expression template, the logical model in

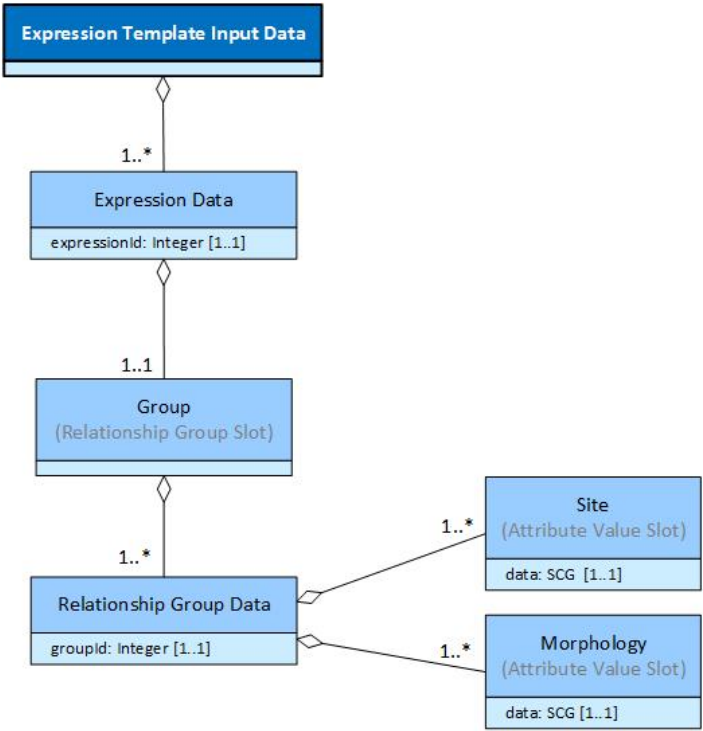
Unknown macro: 'caption-ref'

above can

be specialized as shown below in

Unknown macro: 'caption-ref'

. Please note that this model has been simplified by removing unnamed logical classes, which have a cardinality of 1..1 and no data attribute.



Unknown macro: 'caption-figure'

Unknown macro: 'caption-ref'

below shows some example input data for the above template represented using the tabular

format used in the previous examples. Unknown macro: 'caption-table'

Expression Data	Group	Site	Morphology
1	1	312763008 Bone structure of trunk	72704001 Fracture
	2	84667006 Bone structure of cervical vertebra	72704001 Fracture
2	1	71341001 Bone structure of femur	72704001 Fracture
3	1	12611008 Bone structure of tibia	72704001 Fracture

In addition to this tabular representation, there are a wide variety of other possible formats for representing template input data, including json, xml, tsv, csv etc. The exact format used will depend on the format required by the template processor. For example, the above input data can be represented in JSON as shown below.

Example JSON Representation of Input Data

```
{
  "Expression Data": [
    {
      "Group": [
        {
          "Site": "312763008 |Bone structure of trunk|",
          "Morphology": "72704001 |Fracture|"
        },
        {
          "Site": "84667006 |Bone structure of cervical vertebra|",
          "Morphology": "72704001 |Fracture|"
        }
      ]
    },
    {
      "Group": [
        {
          "Site": "71341001 |Bone structure of femur|",
          "Morphology": "72704001 |Fracture|"
        }
      ]
    },
    {
      "Group": [
        {
          "Site": "12611008 | Bone structure of tibia|",
          "Morphology": "72704001 |Fracture|"
        }
      ]
    }
  ]
}
```

Simplification of Data Representation

While it is important that there is no ambiguity as to how each piece of input data should be used in processing the associated expression template, there are often opportunities to make the input data much simpler than is represented in the full logical model above. In particular:

- When the maximum cardinality of a relationship group is 1, there is no need to include the *relationship group* slot in the input data to group the attributes it contains;
- When the maximum cardinality of an attribute name-value pair is 1, there is no need to include the *attribute name-value pair slot* in the input data to group the corresponding name and value pairs;
- When there is either an attribute name slot with a fixed attribute value, or a fixed attribute name with an attribute value slot, there is no need to include the *attribute name-value pair slot* in the input data to group the corresponding name and value pairs.

With this in mind, the examples in [8. Expression Template Examples](#) simplify the input data, where appropriate, using these assumptions and an implicit association with the logical model described above.