The CellML Metadata 1.0 Specification
Working Draft - 2 November 2001

3 Fundamentals

Metadata is defined within an `<rdf:RDF>` element as shown in Figure 1. The recommended best practice is to define the RDF namespace and any namespaces used by the enclosed metadata on the `<rdf:RDF>` element, even if these namespaces are already defined on the ancestor elements of the `<rdf:RDF>` element. This increases the re-usability of the RDF block. Furthermore, RDF processing software that does not recognise the CellML namespace can still parse a CellML document, extract the RDF blocks, and perhaps provide useful functionality with the information described in the RDF.

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <rdf:Description rdf:about="#some_element_id">
    ...
  </rdf:Description>
</rdf:RDF>
```

**Figure 1**: An example of a metadata definition. The metadata about the element referenced by "some_element_id" has been left out for now.

An `<rdf:RDF>` element typically contains one or more `<rdf:Description>` elements, each of which defines an `<rdf:about>` attribute. The value of the `<rdf:about>` attribute must be a valid Uniform Resource Identifier (URI). Metadata may be associated with the document it is defined in by assigning the `<about>` attribute an empty value (""). Metadata may be associated with an element in the current document by defining an attribute of type ID on that element and assigning the `<about>` attribute on the `<rdf:Description>` element a value equal to the value of that attribute preceded by a hash (#). In CellML, the attribute referred to is the `<cmeta:id>` attribute on any element.

RDF is processed as triplets. A resource is assigned a property of a certain value. For instance, in Figure 2, the resource, the element referenced by "Wilma Flintstone", is assigned a property of `<spouse>` with a value of Fred Flintstone.

If you wanted to also indicate that Wilma’s husband (resource) has a favourite hobby (property) of bowling (value), you could add an `<rdf:id>` attribute to the `<toon:spouse>` element and create another triplet using a second `<rdf:Description>` element, as shown in Figure 3.

Figure 4 shows an alternate method to describe the two triplets shown in Figure 3. The second `<rdf:Description>` element is embedded in the `<toon:spouse>` element to indicate that it is a new resource.

Figure 5 shows yet another way to describe the two triplets. This example uses the `<rdf:parseType>` attribute with a value of "Resource" to introduce a new resource (instead of the `<RDF:Description>` element used in the previous example). The CellML Metadata Specification uses this method frequently because it is less verbose than the methods described in the previous two examples.

1 http://www.ietf.org/rfc/rfc2396.txt
Figure 2: An example of an RDF triple, in which the element referred to by "Wilma Flintstone" is the resource, <spouse> is the property describing the resource, and Fred Flintstone is the property value.

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:toon="http://www.cartoon_times.com/what_namespace">
  <rdf:Description rdf:about="#Wilma_Flintstone">
    <toon:spouse>Fred Flintstone</toon:spouse>
  </rdf:Description>
</rdf:RDF>
```

Figure 3: A set of two RDF triplets, in which the second <rdf:Description> element describes Wilma’s spouse, as indicated by the second rdf:about attribute.

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:toon="http://www.cartoon_times.com/what_namespace">
  <rdf:Description rdf:about="#Wilma_Flintstone">
    <toon:spouse rdf:id="spouse">
      Fred Flintstone
    </toon:spouse>
  </rdf:Description>
  <rdf:Description rdf:about="#spouse">
    <toon:favourite_hobby>bOWLING</toon:favourite_hobby>
  </rdf:Description>
</rdf:RDF>
```

Figure 4: A set of two RDF triplets, as in Figure 3. This example shows that a new resource can be created by embedding the <rdf:Description> element in the element it is describing.

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:toon="http://www.cartoon_times.com/what_namespace">
  <rdf:Description rdf:about="#Wilma_Flintstone">
    <toon:spouse>
      <rdf:Description>
        <rdf:value>Fred Flintstone</rdf:value>
        <toon:favourite_hobby>bOWLING</toon:favourite_hobby>
      </rdf:Description>
    </toon:spouse>
  </rdf:Description>
</rdf:RDF>
```
3.1 Containers

RDF provides the ability to indicate a sequence with the use of containers. The containers `<rdf:Bag>`, `<rdf:Seq>`, and `<rdf:Alt>`, denote an unordered sequence, an ordered sequence, and alternative choices, respectively. Figure 6 demonstrates the use of the `<rdf:Bag>` element. Each family member of the Jetsons is an equal member of the family. They are grouped together using the `<rdf:Bag>` element to show that they all belong to the same family.

The `<rdf:Seq>` element indicates that the members are in a specified order. In the example shown in Figure 7 the `<rdf:Seq>` element is used to list the relative ages of each person.

The `<rdf:Alt>` element indicates that any of the listed items may be chosen, and, generally, the first item listed is the preferred value. Figure 8 shows an example in which a choice is given of two supply companies: Spacely’s Space Sprockets and Cogswell’s Coggs.
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:toon="http://www.cartoon_times.com/what_namespace">
  <rdf:Description rdf:about="#Jetsons">
    <toon:age rdf:parseType="Resource">
      <rdf:Seq>
        <rdf:li>George</li>
        <rdf:li>Jane</li>
        <rdf:li>Judy</li>
        <rdf:li>Elroy</li>
        <rdf:li>Astro</li>
        <rdf:li>Rosie</li>
      </rdf:Seq>
    </toon:age>
  </rdf:Description>
</rdf:RDF>

**Figure 7:** The `<rdf:Seq>` element implies that those listed are in order based on their age.

---

<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:toon="http://www.cartoon_times.com/what_namespace">
  <rdf:Description rdf:about="#companies">
    <toon:supply rdf:parseType="Resource">
      <rdf:Alt>
        <rdf:li>Spacely's Space Sprockets</li>
        <rdf:li>Cogswell's Cogs</li>
      </rdf:Alt>
    </toon:supply>
  </rdf:Description>
</rdf:RDF>

**Figure 8:** The `<rdf:Alt>` element implies that any one of the listed values is valid.
3.2 Dublin Core Elements and Qualifiers

The Dublin Core Metadata Elements and their corresponding qualifiers are listed in Table 2. Each Dublin Core Element is given its own element in the Dublin Core namespace, as shown in Figure 9. The CellML Metadata Specification covers how to use the Dublin Core Qualifiers in later sections.

```xml
<rdf:RDF
    xmlns:dc="http://purl.org/dc/elements/1.1/"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
    <rdf:Description rdf:about="#toon_times">
        <dc:title>Toonville Times</dc:title>
        <dc:creator>R.J. Gopher</dc:creator>
        <dc:date>2001-10-18</dc:date>
    </rdf:Description>
</rdf:RDF>
```

**Figure 9:** Each Dublin Core Metadata Element is its own element in the Dublin Core namespace.
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<th>Element Refinement(s)</th>
<th>Element Encoding Scheme(s)</th>
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Table 2: The Dublin Core Metadata Element Set and their qualifiers.