Mapping SysML into RDF according to OSLC Guidelines

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General Overview of RDF Resources for OSLC Data Interchange

OSLC Requirement Management Vocabulary in RDFS

OSLC Requirement Resource Shape defined in OSLC Core Vocabulary

OSLC Requirement Resource in RDF

Requirement in Tool A

OSLC Adapter for Tool A

HTTP

OSLC Adapter for Tool B

Requirement in Tool B

Tool A

Tool B

refers_to

conforms_to
Example HTTP GET returning OSLC Resource in RDF/XML

HTTP Request
URL: http://.../requirements/ 550e8400
GET Method
Accept: application/rdf+xml

HTTP Response containing web resource in RDF/XML

Client

Server (OSLC Adapter)

HTTP Accept header specifies resource representation expected by the client

Resource URI

HTTP Method

HTTP Accept header specifies resource representation expected by the client
Requirement ID: S5.4.1
Title: Master Cylinder Efficacy
Text: "A master cylinder shall have a reservoir compartment."

OSLC tool adapter publishes tool data as OSLC resources in RDF/XML on the web.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dcterms="http://purl.org/dc/terms/
  xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description
      rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
      <dcterms:identifier>S5.4.1</dcterms:identifier>
      <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
      <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
    </rdf:Description>
</rdf:RDF>
```
RDF = Subject-Predicate-Object Statements

OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:rdf>
  <xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description>
      <rdf:about "http://domain_name.com/tool_name/services/project_name/requirements/550e8400">"/>
      <dcterms:identifier rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">S5.4.1</dcterms:identifier>
      <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
      <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
      <rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
    </rdf:Description>
  </rdf:rdf>
</xml>
```

**Subject**

**Predicates** (properties)

**Objects** (property values)
XML Document

OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>

<rdf:RDF>
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description>
      rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400"
      <dcterms:identifier>S5.4.1</dcterms:identifier>
      <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XQLLiteral" Master Cylinder Efficacy</dcterms:title>
      <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XQLLiteral" A master cylinder shall have a reservoir compartment</dcterms:description>
      <rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
    </rdf:Description>
  </rdf:RDF>
```

Declaration of an XML document specifying XML version and encoding
OSLC Resource in RDF/XML

Declaration of an RDF/XML document with rdf:RDF as top-level element
Declaration of **XML namespaces**. A namespace declaration (e.g. "xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"") includes a name (e.g. "http://www.w3.org/1999/02/22-rdf-syntax-ns#") and possibly also a prefix (e.g. "rdf")
Example **URI reference**. A URI reference (e.g. “rdf:Description”) is converted into a **URI** (e.g. “http://www.w3.org/1999/02/22-rdf-syntax-ns#Description”) by merging it with an absolute 'base' URI (e.g. “http://www.w3.org/1999/02/22-rdf-syntax-ns#”).
QNames = URI References

OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
    <metadata>
        <xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:dcterms="http://purl.org/dc/terms/"
        xmlns:oslc_rm="http://open-services.net/ns/rm#">
            <rdf:Description
                rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
                <dcterms:identifier>S5.4.1</dcterms:identifier>
                <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
                <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
                <rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
            </rdf:Description>
        </metadata>
    </rdf:RDF>
```

QName is an abbreviation for URI reference. A QName ("e.g. rdf:Description") has a prefix ("rdf") and a local part (e.g. "Description")
RDF Resource

OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dcterms="http://purl.org/dc/terms/
  xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description
      rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
      <dcterms:identifier>S5.4.1</dcterms:identifier>
      <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMMILiteral">Master Cylinder Efficacy</dcterms:title>
      <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMMILiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
      <rdfs:resource rdf:resource="http://open-services.net/ns/rm#Requirement"/>
    </rdf:Description>
  </rdf:RDF>
```

**rdf:Description** element describes an **RDF resource**
**Resource URI**

**OSLC Resource in RDF/XML**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:oslcrm="http://open-services.net/ns/rm#">
  <rdf:Description
    rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
    <dcterms:identifier>S5.4.1</dcterms:identifier>
    <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLEntity">
      Master Cylinder Efficacy</dcterms:title>
    <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLEntity">
      A master cylinder shall have a reservoir compartment</dcterms:description>
    <rdfs:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
  </rdf:Description>
</rdf:RDF>
```

**rdf:about** attribute specifies the **resource URI** (subject of an RDF statement). Resources may have no, one or several identifiers and some of these may be URIs. If a resource has at least one URI, the most appropriate one should be used as the value of the rdf:about attribute.
RDF statements describe the characteristics of their subjects using **properties**, or **predicates** in RDF terminology.
Property URI

OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:oslc_rm="http://open-services.net/ns/rm#">
  <rdf:Description
    rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
    <dcterms:identifier>55.4.1</dcterms:identifier>
    <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
    <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
  </rdf:Description>
</rdf:RDF>
```

**Predicates** (properties) have **URIs** (e.g. “http://purl.org/dc/terms/identifier”).
Predicates (properties) have values (literals or resource URIs).
Resource Type

OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
    <xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:dcterms="http://purl.org/dc/terms/"
    xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description
        rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
        <dcterms:identifier>S5.4.1</dcterms:identifier>
        <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
        <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
        <rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
    </rdf:Description>
</rdf:RDF>
```

**rdf:type** is used to state that a resource is an instance of a class (e.g. with a class with the URI “http://open-services.net/ns/rm#Requirement”)
OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:dcterms="http://purl.org/dc/terms/"
    xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description
        rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400"
        dcterms:identifier>S5.4.1</dcterms:identifier>
        dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
        dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
        rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
</rdf:Description>
</rdf:RDF>
```

**rdf:type** is used to state that a resource is an **instance of a class** (e.g. with a class with the URI “http://open-services.net/ns/rm#Requirement”)

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All RDF resources are implicitly instances of the Resource class (URI = http://www.w3.org/2000/01/rdf-schema#Resource, URIref = rdfs:Resource). rdf:type property referring to rdfs:Resource is usually omitted.
OSLC Resource in RDF/XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF
 xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
 xmlns:dcterms="http://purl.org/dc/terms/"
 xmlns:oslc_rm="http://open-services.net/ns/rm#">
  <oslc_rm:Requirement rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
    <dcterms:identifier>S5.4.1</dcterms:identifier>
    <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
    <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
  </oslc_rm:Requirement>
</rdf:RDF>
```

**rdf:Description** tag can be replaced with the type (e.g. “oslc_rm:Requirement”)
Properties and Classes

Properties (e.g. "http://purl.org/dc/terms/identifier") and Classes (e.g. "http://www.w3.org/2000/01/rdf-schema#Resource") can be described by RDF resources.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF>
  <xmlns:oslc_rm="http://open-services.net/ns/rm#">
    <rdf:Description rdf:about="http://domain_name.com/tool_name/services/project_name/requirements/550e8400">
      <dcterms:identifier rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">S5.4.1</dcterms:identifier>
      <dcterms:title rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">Master Cylinder Efficacy</dcterms:title>
      <dcterms:description rdf:datatype="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral">A master cylinder shall have a reservoir compartment</dcterms:description>
      <rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>
      <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
    </rdf:Description>
  </xmlns:oslc_rm>
</rdf:RDF>
```
Property described as RDF Resource

RDF Resource in RDF/XML

```xml
<rdf:Description rdf:about="http://purl.org/dc/terms/identifier">
  <rdfs:label xml:lang="en">Identifier</rdfs:label>
  <rdfs:comment xml:lang="en">
    An unambiguous reference to the resource within a given context. </rdfs:comment>
  <dcterms:description xml:lang="en">
    Recommended best practice is to identify the resource by means of a string
    conforming to a formal identification system. </dcterms:description>
  <dcterms:isDefinedBy rdf:resource="http://purl.org/dc/terms/>
  <dcterms:issued rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2008-01-14</dcterms:issued>
  <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#identifierT-001"/>
  <dcterms:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
  <dcterms:subPropertyOf rdf:resource="http://purl.org/dc/elements/1.1/identifier"/>
</rdf:Description>
```

RDF Resource describing the RDF Property with the URI
http://purl.org/dc/terms/identifier and the URI reference dcterms:identifier

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rdfs:label is a property that may be used to provide a human-readable version of a resource's name. rdfs:comment is a property that may be used to provide a human-readable description of a resource.
rdfs:range is a property that is used to state that the values of a property are instances of one or more classes.

rdfs:domain is a property that is used to state that any resource that has a given property is an instance of one or more classes (not shown in example because this restriction does not apply for the dcterms:identifier property)
Property described as RDF Resource

RDF Resource in RDF/XML

```
<rdf:Description rdf:about="http://purl.org/dc/terms/identifier">
  <rdfs:label xml:lang="en">Identifier</rdfs:label>
  <rdfs:comment xml:lang="en">
    An unambiguous reference to the resource within a given context.
  </rdfs:comment>
  <dcterms:description xml:lang="en">
    Recommended best practice is to identify the resource by means of a string conforming to a formal identification system.
  </dcterms:description>
  <dcterms:isDefinedBy rdf:resource="http://purl.org/dc/terms/>
  <dcterms:issued rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2008-01-14</dcterms:issued>
</rdf:Description>
```

Additional information on the `dcterms:identifier` property
Class described as RDF Resource

RDF Resource in RDF/XML

```xml
<rdfs:Class rdf:about="http://www.w3.org/2000/01/rdf-schema#Resource">  
  <rdfs:isDefinedBy rdf:resource="http://www.w3.org/2000/01/rdf-schema#"/>
  <rdfs:label>Resource</rdfs:label>
  <rdfs:comment>The class resource, everything.</rdfs:comment>
</rdfs:Class>
```

*rdfs:isDefinedBy* is a property that is used to indicate a resource defining the subject resource. This property may be used to indicate an **RDF vocabulary** in which a resource is described.
Class described as RDF Resource

**rdfs:isDefinedBy** is a property that is used to indicate a resource defining the subject resource. This property may be used to indicate an RDF vocabulary in which a resource is described.

```
<rdfs:Class rdf:about="http://open-services.net/ns/rm#Requirement">
  <rdfs:label xml:lang="en-GB">Requirement</rdfs:label>
  <dcterms:description xml:lang="en-GB">Statement of need.</dcterms:description>
  <rdfs:isDefinedBy rdf:resource="http://open-services.net/ns/rm#"/>
  <dcterms:issued>2010-10-10</dcterms:issued>
  <dcterms:modified>2010-10-10</dcterms:modified>
  <oslc:hasBasicShape rdf:resource="http://open-services.net/shapes/rm#requirementShape"/>
  <rdfs:seeAlso rdf:resource="http://open-services.net/bin/view/Main/RmSpecificationV2#RequirementResource"/>
</rdfs:Class>
```

**rdfs:seeAlso** is a property that is used to indicate a resource that might provide additional information about the subject resource.
Classes in RDFS vs. Classes in Object-oriented Programming

Classes in RDFS

- Resources are defined as instances of one or more classes
- Classes and properties are defined separately. Properties are defined globally and aren’t encapsulated as attributes of a class
- **Classes do not define well-formedness constraints**
- **No cardinality constraints on properties**
- Open world assumption makes it **impossible to detect contradictions**

Classes in OO programming

- Objects are defined as instances of one or more classes
- Classes are defined by their properties
- Classes define well-formedness constraints
- cardinality constraints on properties
- Closed world assumption makes it possible to detect contradictions
RDF Vocabularies

• Classes and properties are described as an RDF vocabulary
• **RDF Schema** provides the facilities needed to *describe* such classes and properties (e.g. with the rdfs:definedBy, rdfs:range, and rdfs:domain properties)
• RDF vocabularies have a namespace (e.g. http://www.w3.org/2000/01/rdf-schema#) and are usually identified by their namespace prefix (e.g. RDFS)
• RDF vocabularies are dereferenceable through their namespace URI
Property and Class URIs

Property URIs (e.g. "http://purl.org/dc/terms/identifier") and Class URIs (http://www.w3.org/2000/01/rdf-schema#Resource) belong to a namespace URI (e.g. respectively "http://purl.org/dc/terms/" and "http://www.w3.org/2000/01/rdf-schema#")
According to W3C, the **namespace URI** doesn't have to be dereferenceable, **but it is typically a convention**. An organization will typically use a vocabulary's namespace URI as the URL of a Web resource that provides further information about that vocabulary.
Dereferencing RDF vocabularies

HTTP Request
URL: http://purl.org/dc/terms/
GET Method
Accept: application/rdf+xml

HTTP Response containing RDF vocabulary in RDF/XML

HTTP Accept header specifies resource representation expected by the client

Namespace URI

HTTP Method

Client

Server (OSLC Adapter)
Dereferencing Dublin Core Vocabulary

- http://purl.org/dc/terms/ + Accept header = application/rdf+xml

**RDF/XML** representation of Dublin Core Metadata Initiative (DCMI) Vocabulary

...just a snippet...
Dereferencing Dublin Core Vocabulary

- http://purl.org/dc/terms/ redirects to http://dublincore.org/documents/2012/06/14/dcmi-terms/?v=terms#

**HTML** representation of Dublin Core Metadata Initiative (DCMI) Vocabulary
Tool Interoperability through Standardized RDF Vocabularies

• Interoperability between tools is based on common standards
• OSLC specifications provide RDF vocabularies for specific domains for the purpose of supporting interoperability
Example: Standardized RDF Vocabulary for Requirements

OSLC Requirement Management Vocabulary in RDFS

OSLC Requirement resource refers to standardized OSLC Requirements Management Vocabulary

OSLC Requirement Resource in RDF

Requirement in Tool A

OSLC Adapter for Tool A

HTTP

Requirement in Tool B

OSLC Adapter for Tool B

Tool A

Tool B

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OSLC Requirements Management Vocabulary

- [http://open-services.net/ns/rm#](http://open-services.net/ns/rm#) redirects to [http://open-services.net/bin/view/Main/RmVocabulary#](http://open-services.net/bin/view/Main/RmVocabulary#)

**HTML representation of OSLC RM Vocabulary**
OSLC Requirements Management Vocabulary

- [http://open-services.net/ns/rm#](http://open-services.net/ns/rm#) + Accept header = `application/rdf+xml`

**RDF/XML** representation of OSLC Requirements Management Vocabulary:

```xml
<rdfls:Class rdf:about="http://open-services.net/ns/rm#Requirement">
  <rdfs:label xml:lang="en-GB">Requirement</rdfs:label>
  <dcterms:description xml:lang="en-GB">Statement of need.</dcterms:description>
  <rdfs:isDefinedBy rdf:resource="http://open-services.net/ns/rm#"/>
  <dcterms:issued>2010-10-10</dcterms:issued>
  <dcterms:modified>2010-10-10</dcterms:modified>
  <oslc:hasBasicShape
    rdf:resource="http://open-services-net/shapes/rm#requirementShape"/>
</rdfls:Class>

<rdfls:Property rdf:about="http://open-services.net/ns/rm#elaboratedBy">
  <rdfs:label>elaboratedBy</rdfs:label>
  <rdfs:comment xml:lang="en-GB">An entity which elaborates.</rdfs:comment>
  <dcterms:description xml:lang="en-GB">Expresses an elaboration relationship between entities. For example, a model element can elaborate a requirement.</dcterms:description>
  <rdfs:isDefinedBy rdf:resource="http://open-services.net/ns/rm#"/>
  <dcterms:issued>2008-01-14</dcterms:issued>
  <dcterms:modified>2008-01-14</dcterms:modified>
  <rdfs:seeAlso
    rdf:resource="http://open-services.net/bin/view/Main/RmSpecificationV2#RequirementResource"/>
</rdfls:Property>
```

...just a snippet...

...just a snippet...
Example of Standardized RDF Properties

- OSLC resources describing requirements have standardized properties

Subject: Requirement „Master Cylinder Efficacy“

<table>
<thead>
<tr>
<th>Predicate</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>elaboratedBy</td>
<td>Use Case „Decelerate Car“</td>
</tr>
<tr>
<td>satisfiedBy</td>
<td>Block „Brake System“</td>
</tr>
<tr>
<td>derivedRqt</td>
<td>Requirement „Loss of Fluid“</td>
</tr>
<tr>
<td>derivedRqt</td>
<td>Requirement „Reservoir“</td>
</tr>
</tbody>
</table>

Standardized resource properties enable interoperability

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Standardized RDF Vocabularies are not enough for Tool Interoperability!

RDFS vocabulary does not define well-formedness constraints (e.g. cardinality constraints on properties)
Additional RDF resources for defining constraints on RDF resources: OSLC Resource Shapes

- **RDFS Vocabulary** cannot define constraints on RDF data
- **OSLC Core vocabulary** includes additional RDFS classes and RDF properties for defining constraints on RDF data such as:
  - RDFS class `oslc:ResourceShape`
  - RDFS class `oslc:AllowedValues`
  - RDF property `oslc:occurs`
  - RDF property `oslc:allowedValue`

- **OSLC resource shapes** are RDF resources that define constraints on RDF data by using the OSLC Core vocabulary
A resource shape describes constraints on properties of resources of a specific type (e.g. property value-type, property cardinality, property allowed values).

See OSLC 2.0 Appendix A Common Properties for the complete specification: http://openservices.net/bin/view/Main/OSLCCoreSpecAppendixA?sortcol=table;up=#oslc_ResourceShape_Resource
RDF resource of type ResourceShape (URI = http://open-services.net/ns/core#ResourceShape)

```xml
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
  <oslc:describes rdf:resource="http://open-services.net/ns.rm#Requirement"/>
  <oslc:property>
    <oslc:name>satisfiedBy</oslc:name>
    <oslc:propertyDefinition rdf:resource="http://open-service.net/ns.rm#satisfiedBy"/>
    <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-many"/>
    <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
  </oslc:property>
</oslc:ResourceShape>
```

...just a snippet...
OSLC Resource Shape for Requirements

URI of resource shape (resource shape typically hosted by tool-specific OSLC service provider)

```
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
  <oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>
  <oslc:property>
    <oslc:Property>
      <oslc:name>satisfiedBy</oslc:name>
      <oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
      <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-many"/>
      <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
    </oslc:Property>
  </oslc:property>
</oslc:ResourceShape>
```

...just a snippet...
OSLC Resource Shape for Requirements

**oslc:describes** is a property indicating that the resource shape applies to resources which are instances of this resource type (e.g. http://open-services.net/ns/rm#Requirement)

```
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
  <oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>

  <oslc:Property>
    <oslc:name>satisfiedBy</oslc:name>
    <oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
    <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-many"/>
    <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
  </oslc:Property>

  <oslc:property/>
</oslc:ResourceShape>
```

...just a snippet...
OSLC Resource Shape for Requirements

```
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
  <oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>
  <oslc:property>
    <oslc:Property>
      <oslc:name>satisfiedBy</oslc:name>
      <oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
      <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-many"/>
      <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
    </oslc:Property>
  </oslc:property>
</oslc:ResourceShape>
```

**oslc:property** is an RDF property to describe a resource shape property and associated constraints

...just a snippet...
OSLC Resource Shape for Requirements

```xml
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
    <oslc:describes rdf:resource="http://open-services.net/ns/RM#Requirement"/>
    <oslc:property>
        <oslc:Property>
            <oslc:name>satisfiedBy</oslc:name>
            <oslc:propertyDefinition rdf:resource="http://open-service.net/ns/RM#satisfiedBy"/>
            <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-Many"/>
            <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
        </oslc:Property>
    </oslc:property>
</oslc:ResourceShape>
```

`oslc:propertyDefinition` indicates the URI of the property whose usage is being constrained

...just a snippet...
OSLC Resource Shape for Requirements

```xml
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
  <oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>
  <oslc:property>
    <oslc:Property>
      <oslc:name>satisfiedBy</oslc:name>
      <oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
      <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-many"/>
      <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
    </oslc:Property>
  </oslc:property>
</oslc:ResourceShape>
```

`oslc:occurs` indicates the cardinality of the constrained RDF property

...just a snippet...
OSLC Resource Shape for Requirements

```xml
<oslc:ResourceShape rdf:about="https://myDomain.com/myTool/shapes/ShapeID23">
  <oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>
  <oslc:property>
    <oslc:Property>
      <oslc:name>satisfiedBy</oslc:name>
      <oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
      <oslc:occurs rdf:resource="http://open-service.net/ns/core#Zero-or-many"/>
      <oslc:range rdf:resource="http://open-services.net/ns/core#Any"/>
    </oslc:Property>
  </oslc:property>
</oslc:ResourceShape>
```

*oslc:range* specifies the range of possible resource types allowed

...just a snippet...
Links between RDF Resources in OSLC Integration Scenario

OSLC Requirement Management Vocabulary in RDFS

OSLC Requirement Resource in RDF

Tool A

OSLC Adapter for Tool A

HTTP

OSLC Adapter for Tool B

Tool B

Requirement in Tool A

Requirement in Tool B

<rdf:type rdf:resource="http://open-services.net/ns/rm#Requirement"/>

refsTo

refersTo

rdf:type

OSLC Requirement Management Vocabulary in RDFS
Links between RDF Resources in OSLC Integration Scenario

OSLC Requirement Management Vocabulary in RDFS

refersTo

OSLC Requirement Resource Shape defined with OSLC Core Vocabulary

<oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>

<oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
Links between RDF Resources in OSLC Integration Scenario

OSLC Requirement Resource Shape defined with OSLC Core Vocabulary

`oslc:instanceShape` indicates the URI of a Resource Shape that applies to the resource

```xml
<oslc:instanceShape rdf:resource="https://myDomain.com/myTool/shapes/ShapeID23"/>
```
A shape $S$ applies to a resource $R$ if there is a triple $R$ rdf:type $T$ and there is a triple $S$ oslc:describes $T$, or if there is a triple $R$ oslc:instanceShape $S$.
Required RDF Resources for having OSLC Resources describing **OMG SysML** Elements

- **OSLC Vocabulary for SysML in RDFS**
- **OSLC Resource Shapes for SysML** defined with OSLC Core Vocabulary

```plaintext
oslc:describes
oslc:propertyDefinition

rdf:type

oslc:instanceShape

OSLC Resource of SysML Element in RDF
```
# Required RDF Resources for having OSLC Resources describing **OMG SysML** Elements

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<tr>
<th>Specifications and resources that need to be provided by OMG</th>
<th>Example based on existing OSLC Requirements Management Specification</th>
</tr>
</thead>
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<tr>
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<td><a href="http://open-services.net/ns/rm">http://open-services.net/ns/rm</a></td>
</tr>
<tr>
<td>SysML vocabulary in RDF/XML</td>
<td><a href="http://open-services.net/ns/rm">http://open-services.net/ns/rm</a></td>
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<tr>
<td>SysML vocabulary in HTML</td>
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<td><a href="http://open-services.net/bin/view/Main/RmSpecificationV2Shapes">http://open-services.net/bin/view/Main/RmSpecificationV2Shapes</a></td>
</tr>
</tbody>
</table>
Any Questions?

Contact me at axel.reichwein@koneksys.com