Mapping SysML into RDF according to OSLC Guidelines

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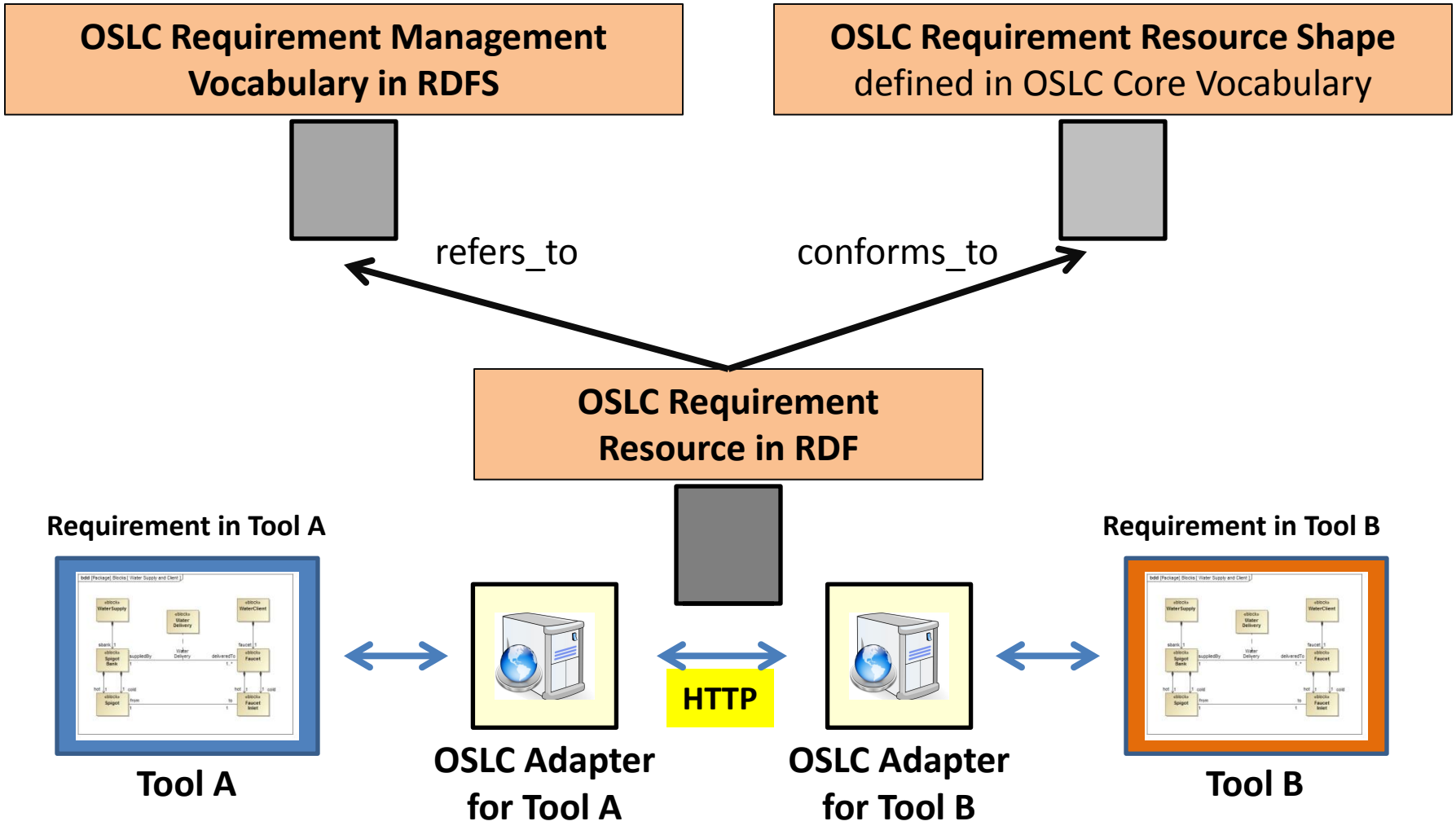
December 13, 2013

General Overview of RDF Resources for OSLC Data Interchange



Example HTTP GET returning OSLC Resource in RDF/XML

HTTP Accept header specifies resource representation expected by the client

Resource URI

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

HTTP Method

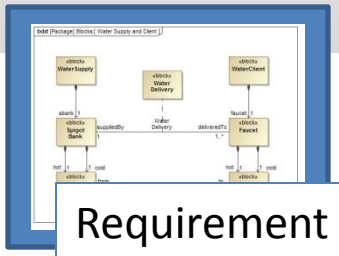
Server
(OSLC Adapter)

Client

HTTP Response containing web resource in RDF/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>
```

OSLC Resource in RDF/XML



Requirement in tool X

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

OSLC Resource in RDF/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 = Subject-Predicate-Object Statements

OSLC Resource in RDF/XML

Subject

```
<?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>
```

Objects (property values)

Predicates (properties)

XML Document

OSLC Resource in RDF/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>
```

Declaration of an **XML document** specifying XML version and encoding

RDF/XML Document with rdf:RDF tag

OSLC Resource in RDF/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>
```

Declaration of an **RDF/XML document** with **rdf:RDF** as top-level element

XML Namespaces

OSLC Resource in RDF/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>
```

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*“)

URI References / URIs

OSLC Resource in RDF/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>
```

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 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>
```

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 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:Description element describes an **RDF resource**

Resource URI

OSLC Resource in RDF/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: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

Resource Properties

OSLC Resource in RDF/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 statements describe the characteristics of their subjects using **properties**, or ***predicates*** in RDF terminology.

Property URI

OSLC Resource in RDF/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>$5.4.1</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>
```

Predicates (properties) have **URIs** (e.g. “http://purl.org/dc/terms/identifier”).

Property Values

OSLC Resource in RDF/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>
```

Predicates (properties) have values (**literals** or **resource URIs**).

Resource Type

OSLC Resource in RDF/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”)

Resource Type

OSLC Resource in RDF/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”)

rdfs:Resource Class

```
<?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:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
    </rdf:Description>
</rdf:RDF>
```

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

Alternative Notation

OSLC Resource in RDF/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

OSLC Resource in RDF/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:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
    </rdf:Description>
</rdf:RDF>
```

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

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>
        <rdfs: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:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#date">
        2008-01-14</dcterms:modified>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#identifierT-001"/>
        <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
        <rdfs: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***

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>
        <rdfs: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:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#date">
        2008-01-14</dcterms:modified>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#identifierT-001"/>
        <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
        <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/elements/1.1/identifier"/>
</rdf:Description>
```

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.

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>
        <rdfs: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:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#date">
        2008-01-14</dcterms:modified>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#identifierT-001"/>
        <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
        <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/elements/1.1/identifier"/>
</rdf:Description>
```

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

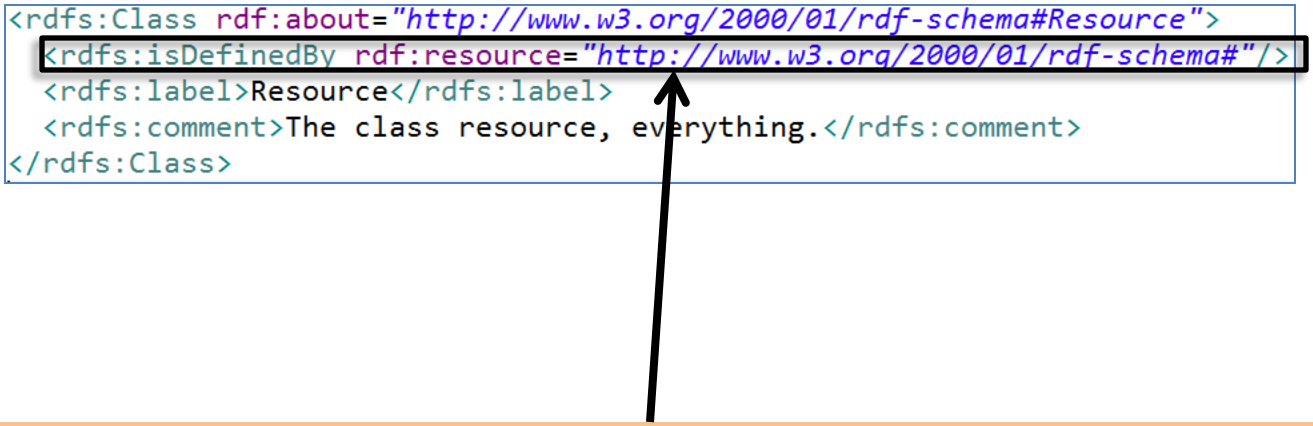
RDF Resource in RDF/XML

```
<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>
        <rdfs: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:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#date">
        2008-01-14</dcterms:modified>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#identifierT-001"/>
        <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
        <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/elements/1.1/identifier"/>
</rdf:Description>
```

Additional information on the ***dcterms:identifier*** property

Class described as RDF Resource

RDF Resource in RDF/XML



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

OSLC Resource in RDF/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:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
    </rdf:Description>
</rdf:RDF>
```

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#*“)

Dereferenceable Namespace URIs

OSLC Resource in RDF/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:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
    </rdf:Description>
</rdf:RDF>
```

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 Accept header specifies resource representation expected by the client

Namespace URI

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

HTTP Method

Server
(OSLC Adapter)

Client

HTTP Response containing RDF vocabulary in RDF/XML

```
<rdf:RDF

    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"

    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"

    xmlns:owl="http://www.w3.org/2002/07/owl#"

    xmlns:dc="http://purl.org/dc/elements/1.1/">
    <owl:Ontology
     rdf:about="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
        <dc:title>The RDF Vocabulary (RDF)</dc:title>
        <dc:description>This is the RDF Schema for the RDF vocabulary defined in the RDF namespace.</dc:description>
    </owl:Ontology>
    <!-- Added by Ivan Herman, 2010-12-30, from here... -->
    <rdfs:Datatype rdf:about="http://www.w3.org/1999/02/22-rdf-syntax-ns#PlainLiteral">
        <rdfs:subClassOf rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
        <rdfs:isDefinedBy rdf:resource="http://www.w3.org/TR/rdf-plain-literal/"/>
        <rdfs:label>PlainLiteral</rdfs:label>
        <rdfs:comment>The class of plain (i.e. untyped) literal values.</rdfs:comment>
    </rdfs:Datatype>
```

Dereferencing Dublin Core Vocabulary

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

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

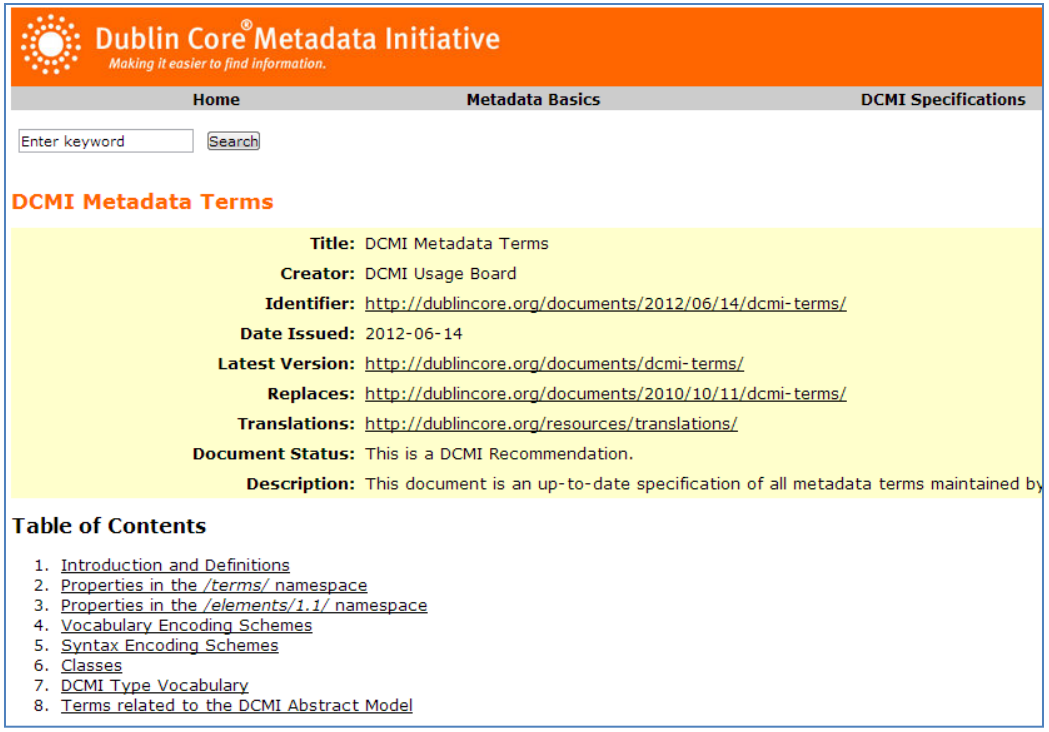
```
<rdf:RDF
    xmlns:owl="http://www.w3.org/2002/07/owl#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#"
    xmlns:dcam="http://purl.org/dc/dcam/"
    xmlns:dcterms="http://purl.org/dc/terms/"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
    <rdf:Description rdf:about="http://purl.org/dc/terms/">
        <dcterms:title xml:lang="en">DCMI Metadata Terms - other</dcterms:title>
        <dcterms:publisher rdf:resource="http://purl.org/dc/aboutdcmi#DCMI"/>
        <dcterms:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2012-06-14</dcterms:modified>
    </rdf:Description>
    <rdf:Description rdf:about="http://purl.org/dc/terms/title">
        <rdfs:label xml:lang="en">Title</rdfs:label>
        <rdfs:comment xml:lang="en">A name given to the resource.</rdfs:comment>
        <rdfs: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:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2010-10-11</dcterms:modified>
        <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
        <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#titleT-002"/>
        <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
        <rdfs:subPropertyOf rdf:resource="http://purl.org/dc/elements/1.1/title"/>
    </rdf:Description>
```

…just a snippet…

Dereferencing Dublin Core Vocabulary

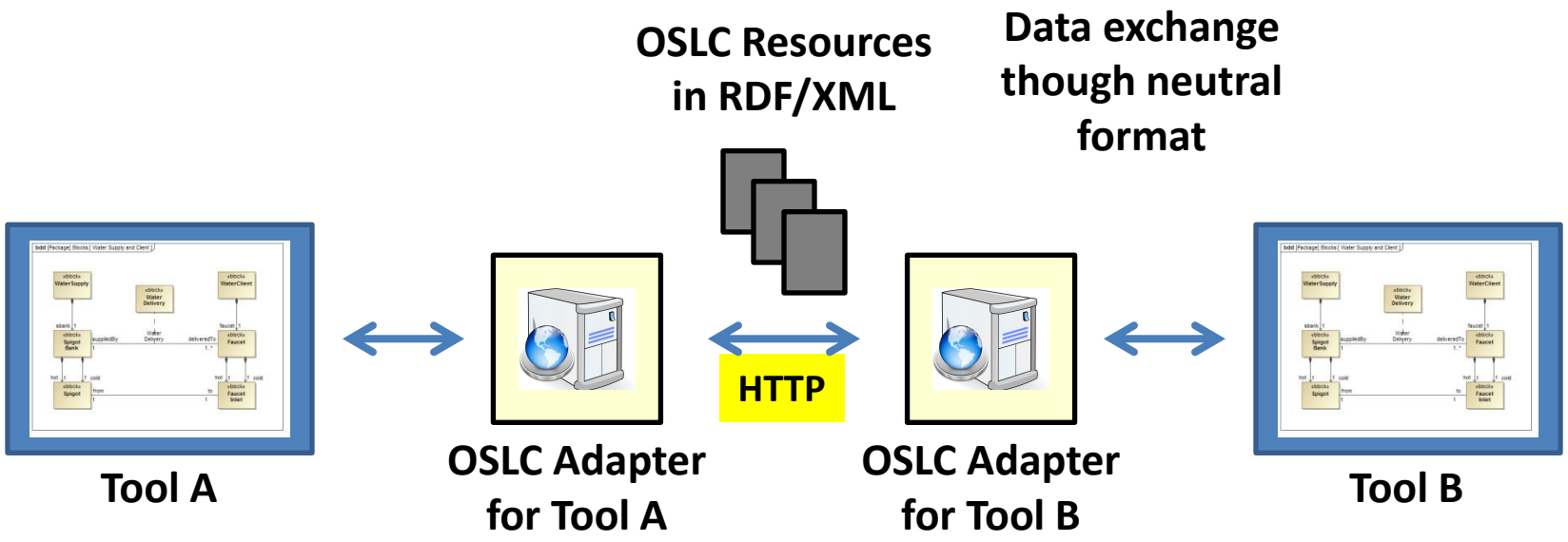
- http://purl.org/dc/terms/ redirects to http://dublincore.org/documents/2012/06/14/dcmi-terms/?v=terms#

HTML representation of Dublin Core Metadata Initiative (DCMI) Vocabulary

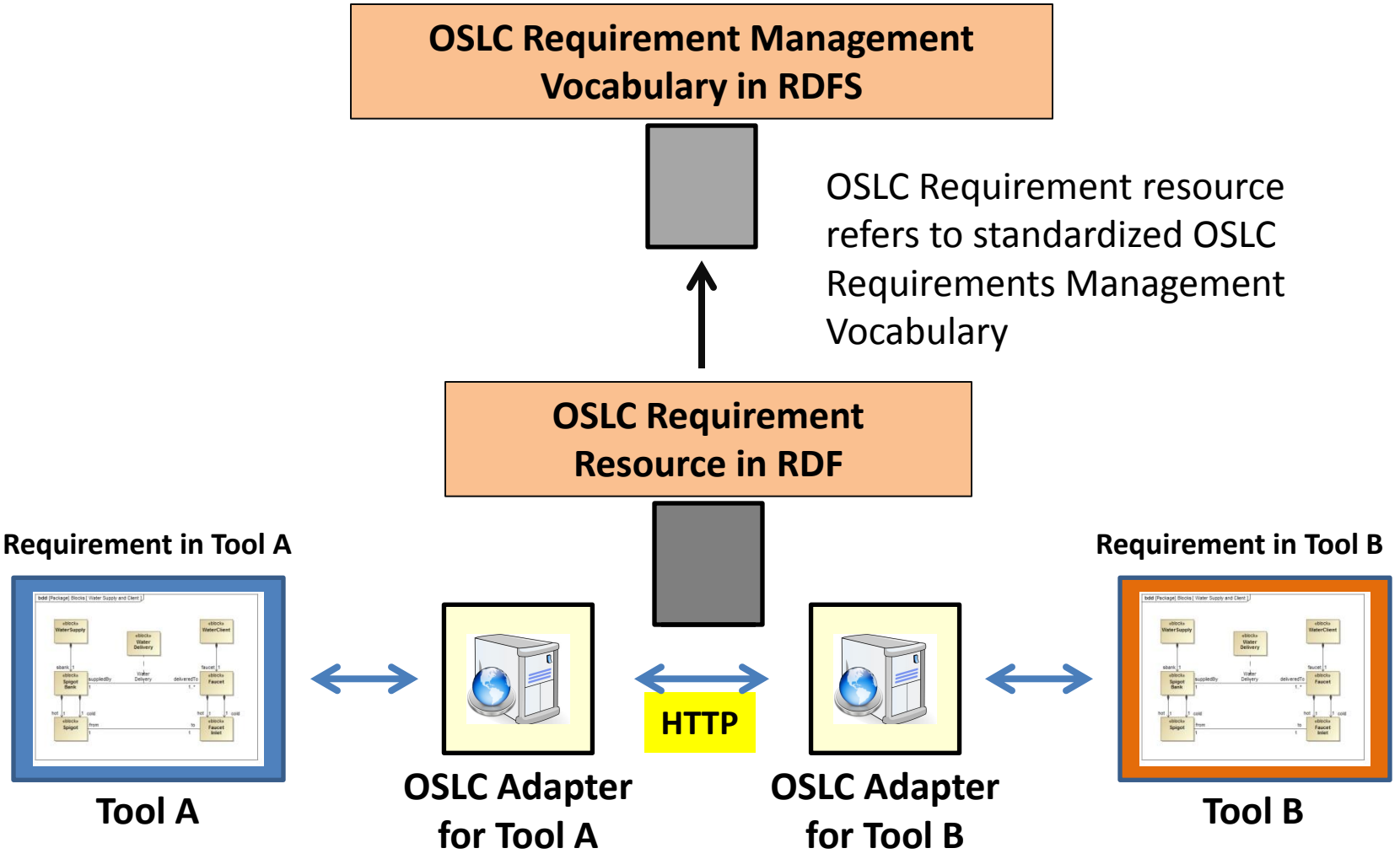


Tool Interoperability through Standardized RDF Vocabularies

- Interoperability between tools is based on common standards
- OSLC specifications provide RDF vocabularies for specific domains for the purpose of supporting interoperability



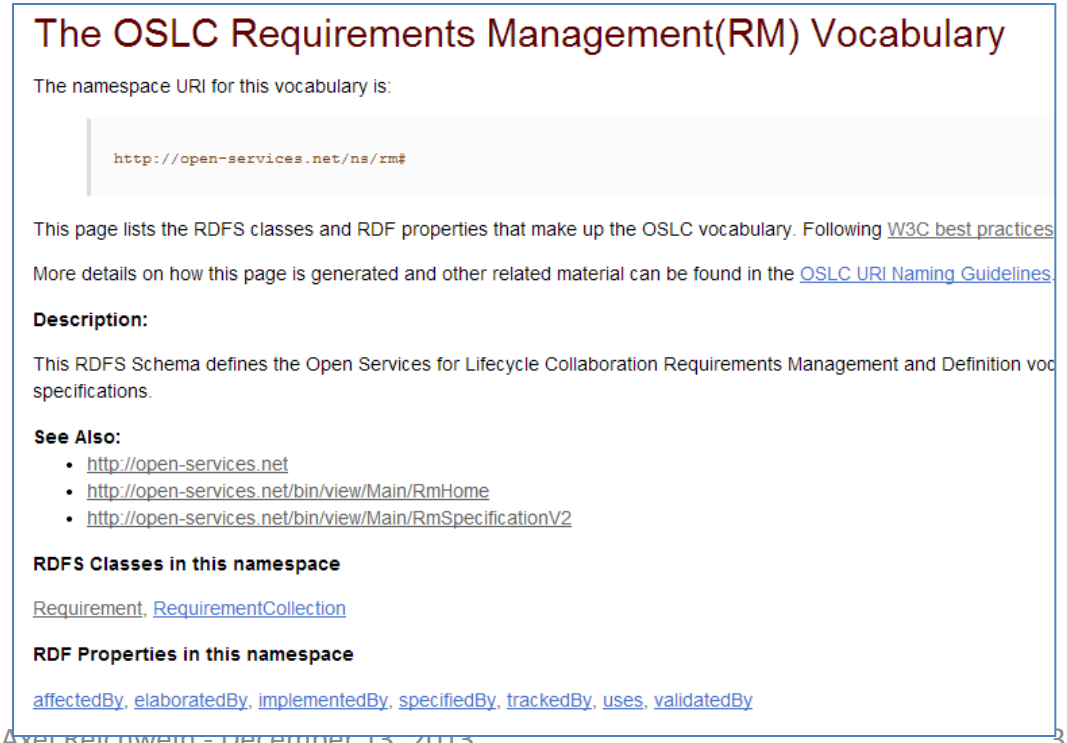
Example: Standardized RDF Vocabulary for Requirements



OSLC Requirements Management Vocabulary

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

HTML representation of OSLC RM Vocabulary



The OSLC Requirements Management(RM) Vocabulary

The namespace URI for this vocabulary is:

```
http://open-services.net/ns/rm#
```

This page lists the RDFS classes and RDF properties that make up the OSLC vocabulary. Following W3C best practices

More details on how this page is generated and other related material can be found in the OSLC URI Naming Guidelines.

Description:

This RDFS Schema defines the Open Services for Lifecycle Collaboration Requirements Management and Definition voc specifications.

See Also:

- http://open-services.net
- http://open-services.net/bin/view/Main/RmHome
- http://open-services.net/bin/view/Main/RmSpecificationV2

RDFS Classes in this namespace

Requirement, RequirementCollection

RDF Properties in this namespace

affectedBy, elaboratedBy, implementedBy, specifiedBy, trackedBy, uses, validatedBy

OSLC Requirements Management Vocabulary

- http://open-services.net/ns/rm# + *Accept header = application/rdf+xml*

RDF/XML representation of OSLC Requirements Management Vocabulary

```
<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"/>
```

…just a snippet…

```
<rdf: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"/>
</rdf:Property>
```

…just a snippet…

Example of Standardized RDF Properties

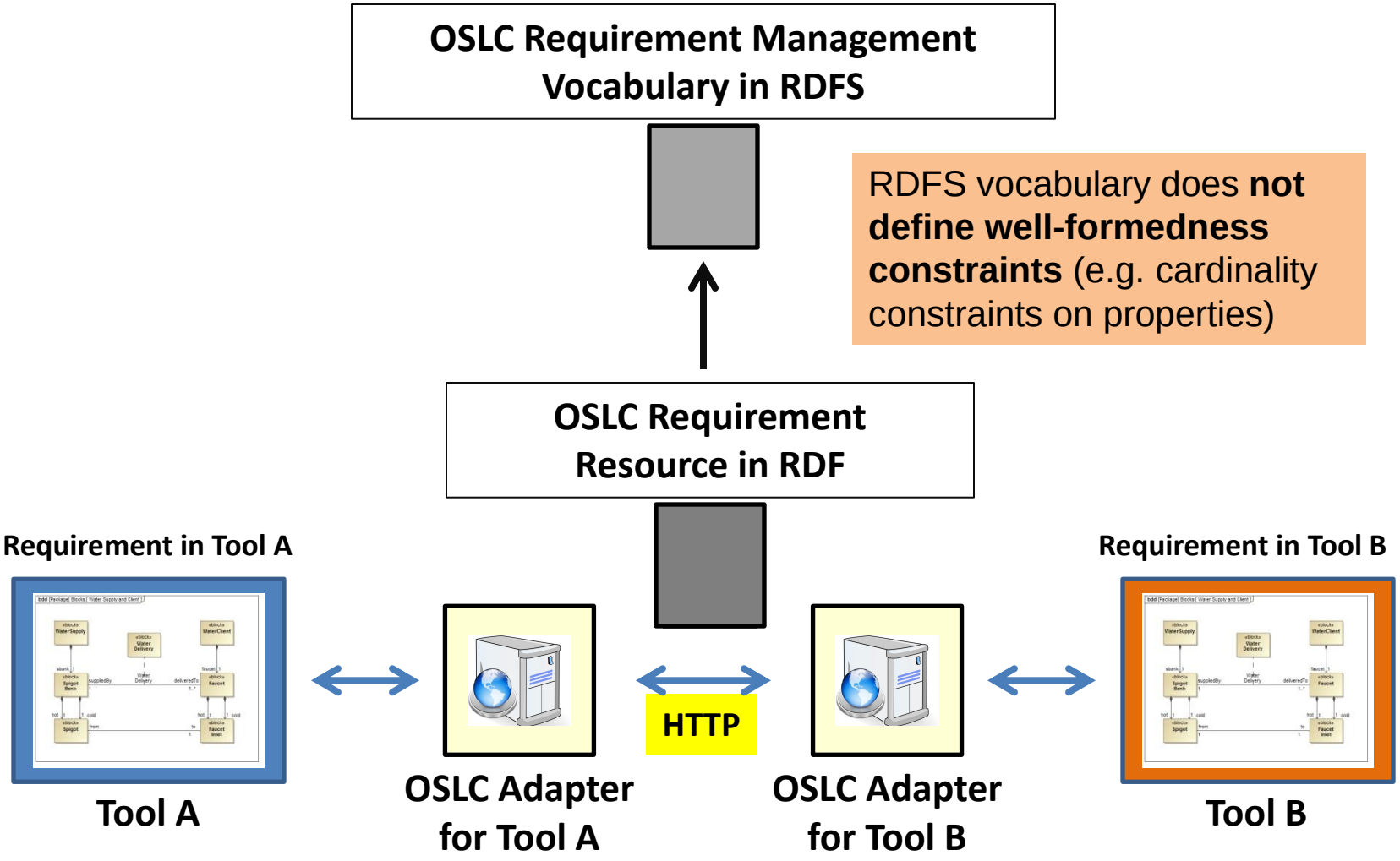
- OSLC resources describing requirements have standardized properties

Subject: Requirement
„Master Cylinder Efficacy“

Predicate	Object
elaboratedBy	Use Case „Decelerate Car“
satisfiedBy	Block „Brake System“
derivedRqt	Requirement „Loss of Fluid“
derivedRqt	Requirement „Reservoir“

Standardized resource properties enable interoperability

Standardized RDF Vocabularies are not enough for Tool Interoperability!

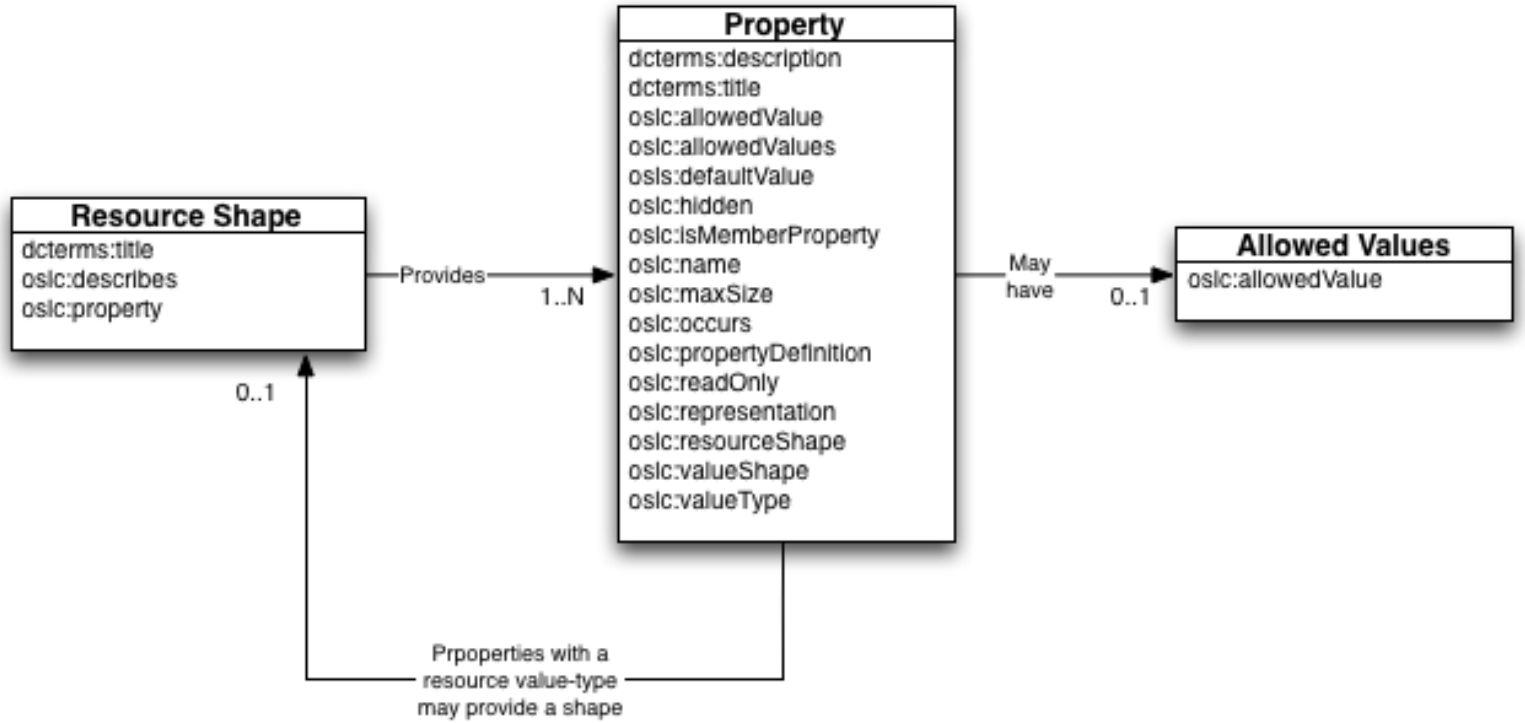


Additional RDF resources for defining constraints on RDF resources: OSLC Resource Shapes

- **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

OSLC Resource Shape

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://open-services.net/bin/view/Main/OSLCCoreSpecAppendixA?sortcol=table;up=#oslc_ResourceShape_Resource

OSLC Resource Shape for Requirements

RDF resource of type ResourceShape (URI = http://open-services.net/ns/core#ResourceShape)

```
<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

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: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>
```

…just a snippet…

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

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>
```

…just a snippet…

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

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>
```

…just a snippet…

oslc:occurs indicates the cardinality of the constrained RDF property

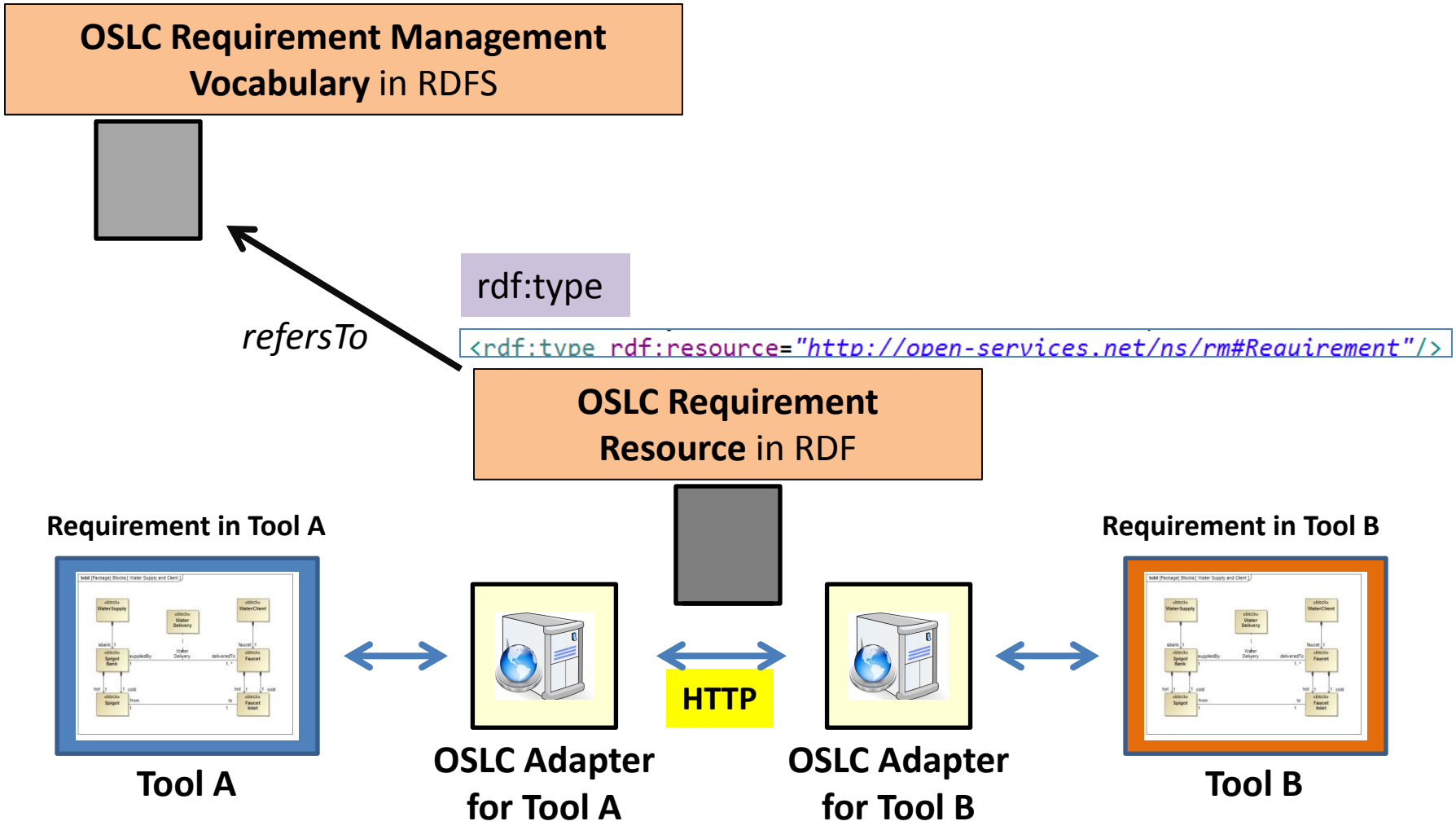
OSLC Resource Shape for Requirements

```
<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>
```

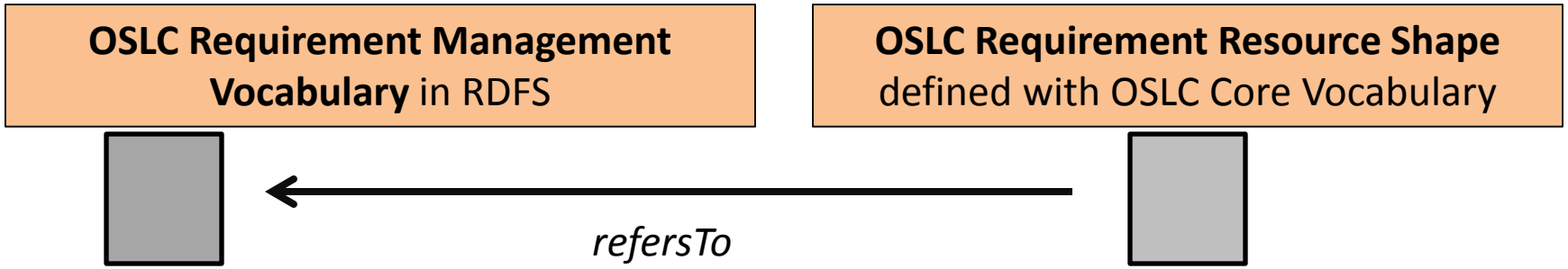
…just a snippet…

oslc:range specifies the range of possible resource types allowed

Links between RDF Resources in OSLC Integration Scenario

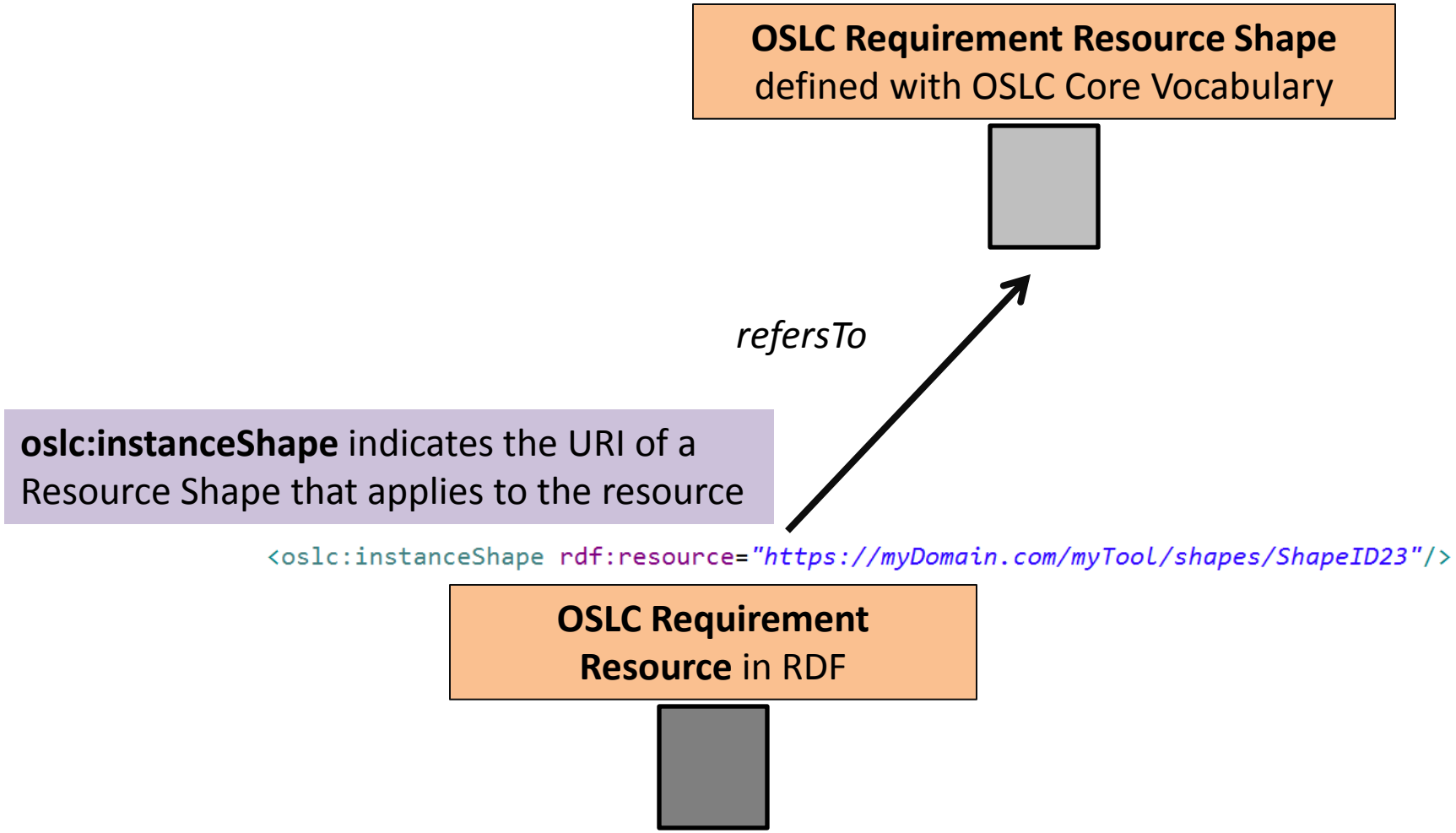


Links between RDF Resources in OSLC Integration Scenario

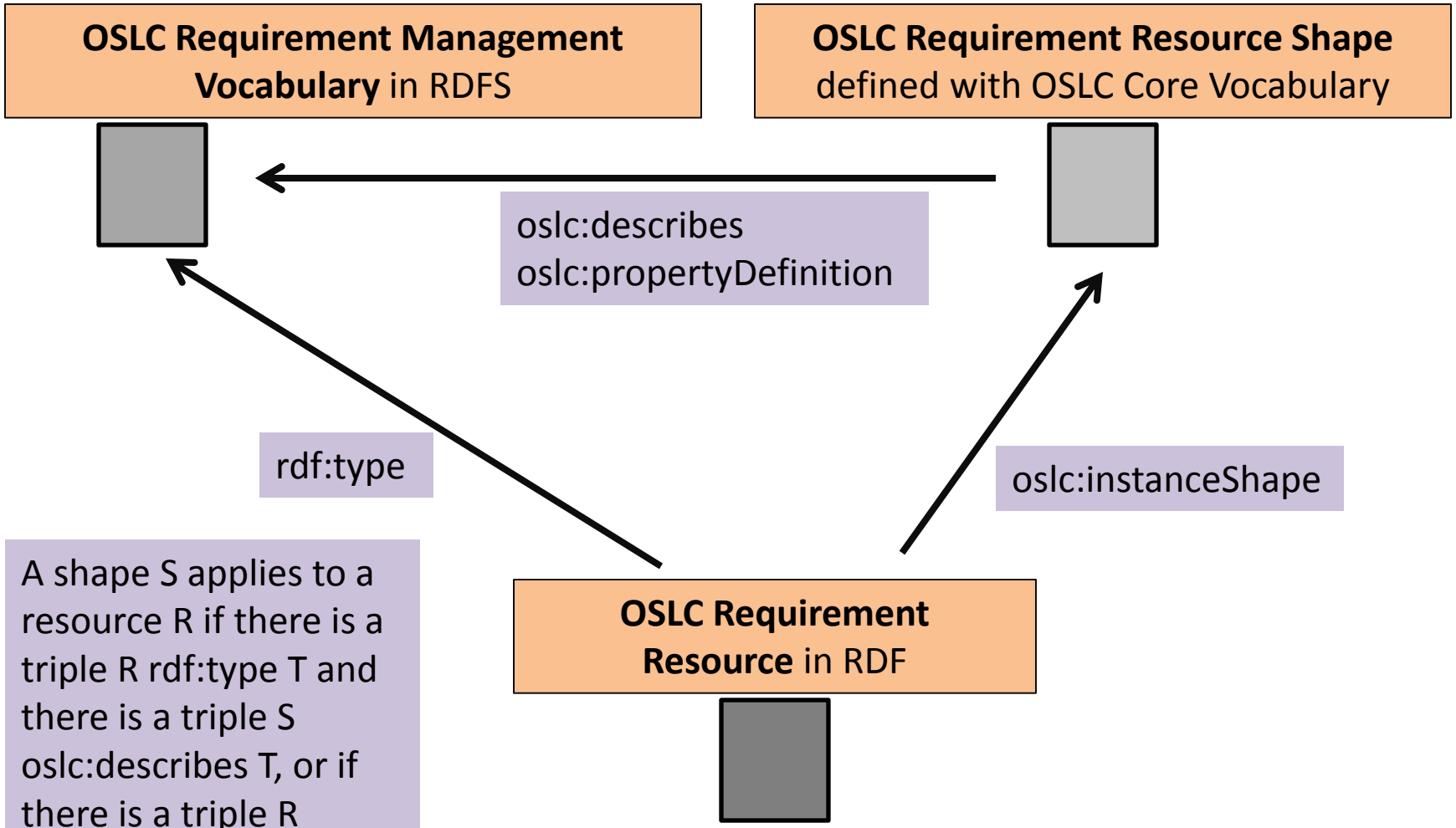



```
<oslc:describes rdf:resource="http://open-services.net/ns/rm#Requirement"/>
<oslc:propertyDefinition rdf:resource="http://open-service.net/ns/rm#satisfiedBy"/>
```

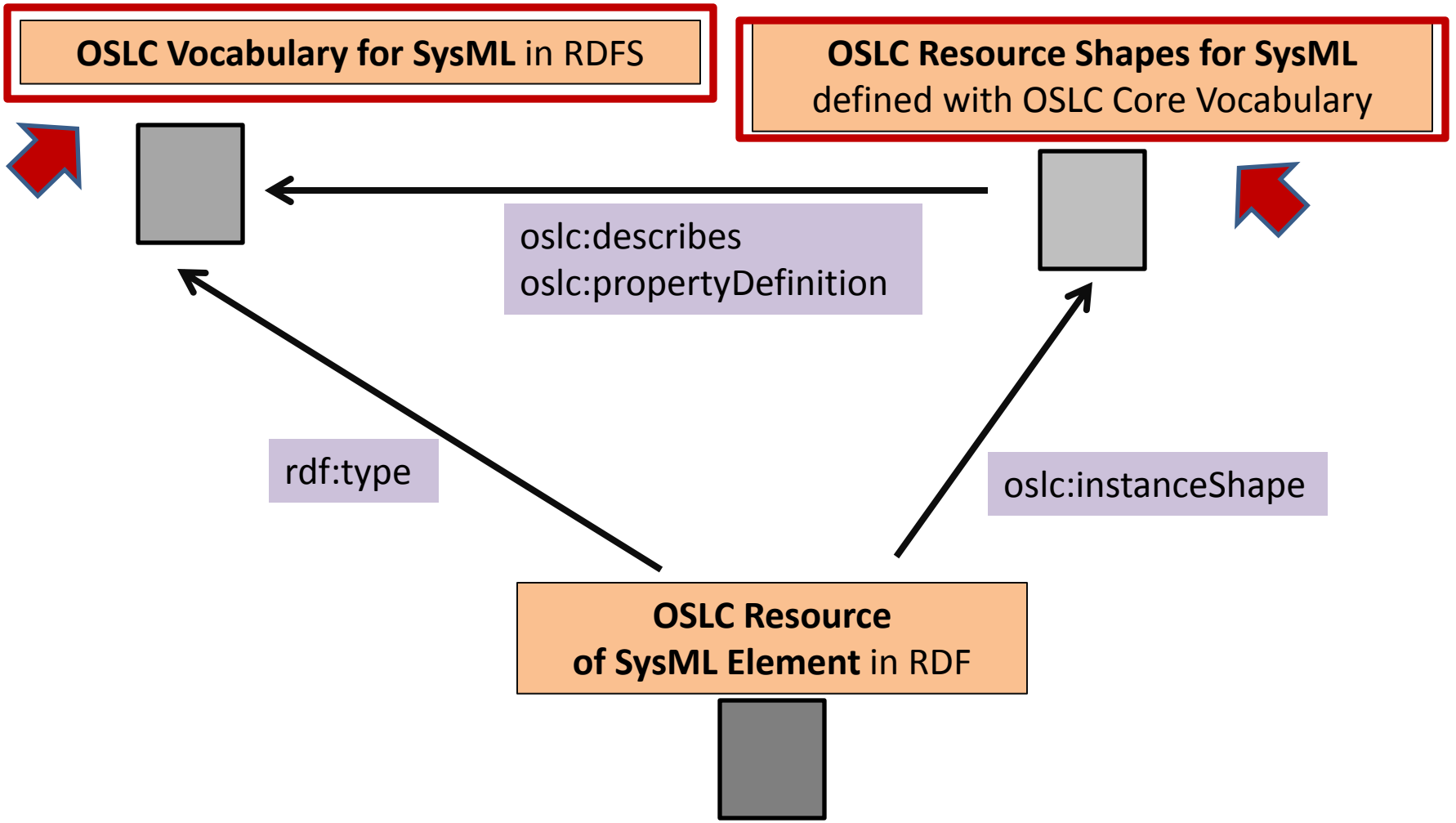
Links between RDF Resources in OSLC Integration Scenario



Overview of Links between RDF Resources in OSLC Integration Scenario



Required RDF Resources for having OSLC Resources describing **OMG SysML** Elements



Required RDF Resources for having OSLC Resources describing **OMG SysML** Elements

Specifications and resources that need to be provided by OMG	Example based on existing OSLC Requirements Management Specification
Namespace URI for SysML vocabulary	http://open-services.net/ns/rm
SysML vocabulary in RDF/XML	http://open-services.net/ns/rm
SysML vocabulary in HTML	http://open-services.net/bin/view/Main/RmSpecificationV2
OSLC resource shapes in RDF/XML	http://open-services.net/bin/view/Main/RmSpecificationV2Shapes

Any Questions?

Contact me at axel.reichwein@koneksys.com