

OSLC4MBSE

OSLC Crash-Course

Resources and Shapes

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Restricted to OSCL4MBSE Group

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Goal of this session for our WG

Understand the OSLC concepts of resource and shape

- In our case we would use existing resource definition and define resource shapes for our purpose

Discussion on XML namespace for OMG SysML 1.3

Discussion on OSLC4MBSE (initially SysML) concepts to be defined as resources and shapes

Applying common Interoperability and Traceability in the Safety Analysis and Requirements Management Domain using OSLC

EXAMPLE PROBLEM

Project Description

Name: Applying common Interoperability and Traceability in the Safety Analysis and Requirements Management Domain using OSLC

Short Name: OSLC4RWB

Purpose: Requirements Management and Traceability

Duration: June 2012 – September 2012

Short Description: Integration of IBM Rational DOORS 9.4 and Isograph RWB FT+ based on OSLC

Full Description:

This project is intended to deliver a functional solution, of how to integrate the domains of “Requirement” and “Safety”. As well as a technical solution of how to apply interoperability between Isograph RWB FT+ and DOORS. The intention is to provide a first solution which may be used for demonstration purposes and future industrial level development. During this project an RWB (FT+) OSLC-AM interface will be developed using the RWB DLL. This OSLC-AM interface allows the interoperability with an existing OSLC-RM interface in IBM Rational DOORS 9.4, in order to build a collaborative engineering environment.

Project Manager:

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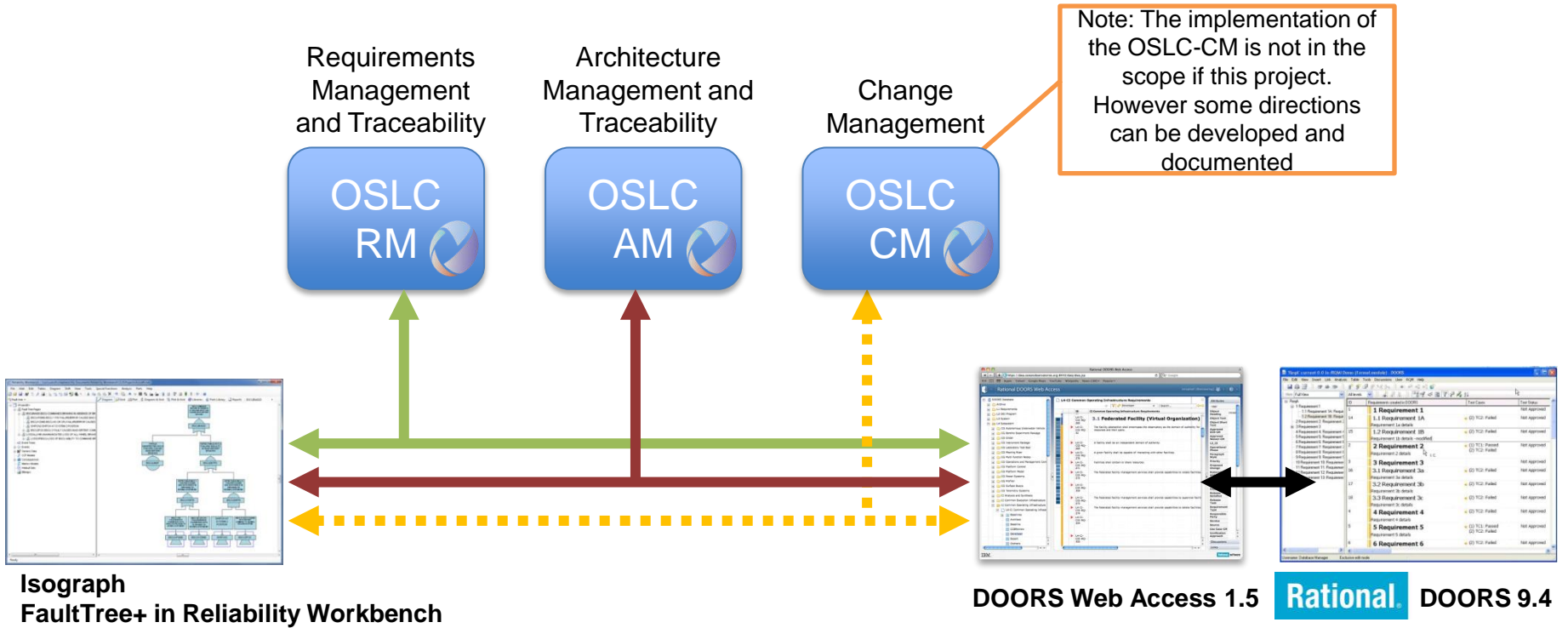
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Steve Booth, Isograph, sbooth@isograph.com

Integration Scenario



Product Website:

FaultTree+ in Reliability Workbench:

IBM Rational DOORS:

OSLC:

<http://www.isograph-software.com/ftpover.htm>

<http://www-142.ibm.com/software/products/gb/en/ratidoor>

<http://open-services.net>

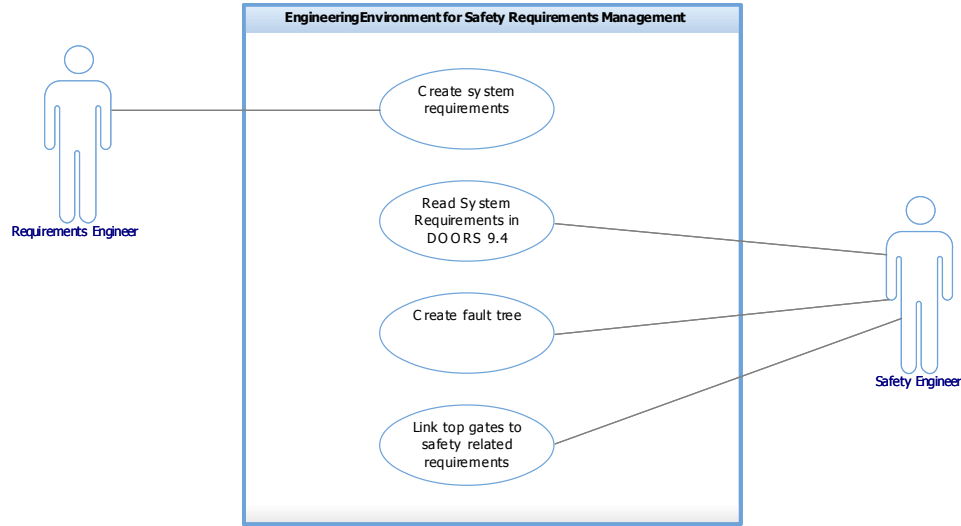
Use Case

Linking of Safety Requirements to Fault Tree Top Gates (or top level event) to apply traceability

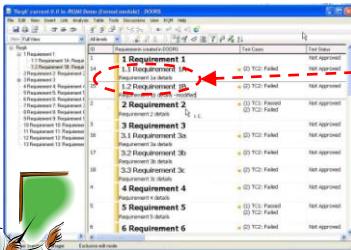
Fault Tree Analysis based on SAE ARP4761 and IEC 61508

Desc.: Safety requirements based on the IEC 61508 are available in DOORS and a fault tree has been build based on the requirements. The safety engineer can now link the fault tree top level gates (top level event) in the created fault tree to the safety requirements in DOORS.

DAL, DO-178B/C

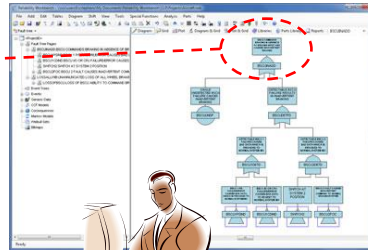


Safety Requirements in DOORS 9.4



<<validates>>

Fault Tree in RWB FaultTree+



Background on IEC 61508 and SIL

The **IEC 61508** is an international standard of rules for safety in industry developed by the IEC (International Electrotechnical Commission). It covers the complete safety lifecycle from analysis, to realisation, to operation. It advises that either qualitative or quantitative hazard and risk assessment can be used.

SIL (the Safety Integration Level) is a level between 1 and 4 and is determined based on reliability, failure to safety and systematic techniques and verification. The SIL is set based on requirements within two broad categories, hardware safety integration and systematic safety integration and to reach a specific SIL the categories must be met at both hardware and system level.

The SIL requirements for hardware safety integrity are based on a probabilistic analysis of the device. To achieve a given SIL, the device must meet targets for the maximum probability of dangerous failure and a minimum Safe Failure Fraction. The concept of 'dangerous failure' must be rigorously defined for the system in question, normally in the form of requirement constraints whose integrity is verified throughout system development. The actual targets required vary depending on the likelihood of a demand, the complexity of the device(s), and types of redundancy used.

The SIL based on reliability is shown in the table below. Low demand mode is defined as the frequency of demand for operation being less than or equal to once per year and high demand is defined as the frequency of demand for operation being greater than once per year.

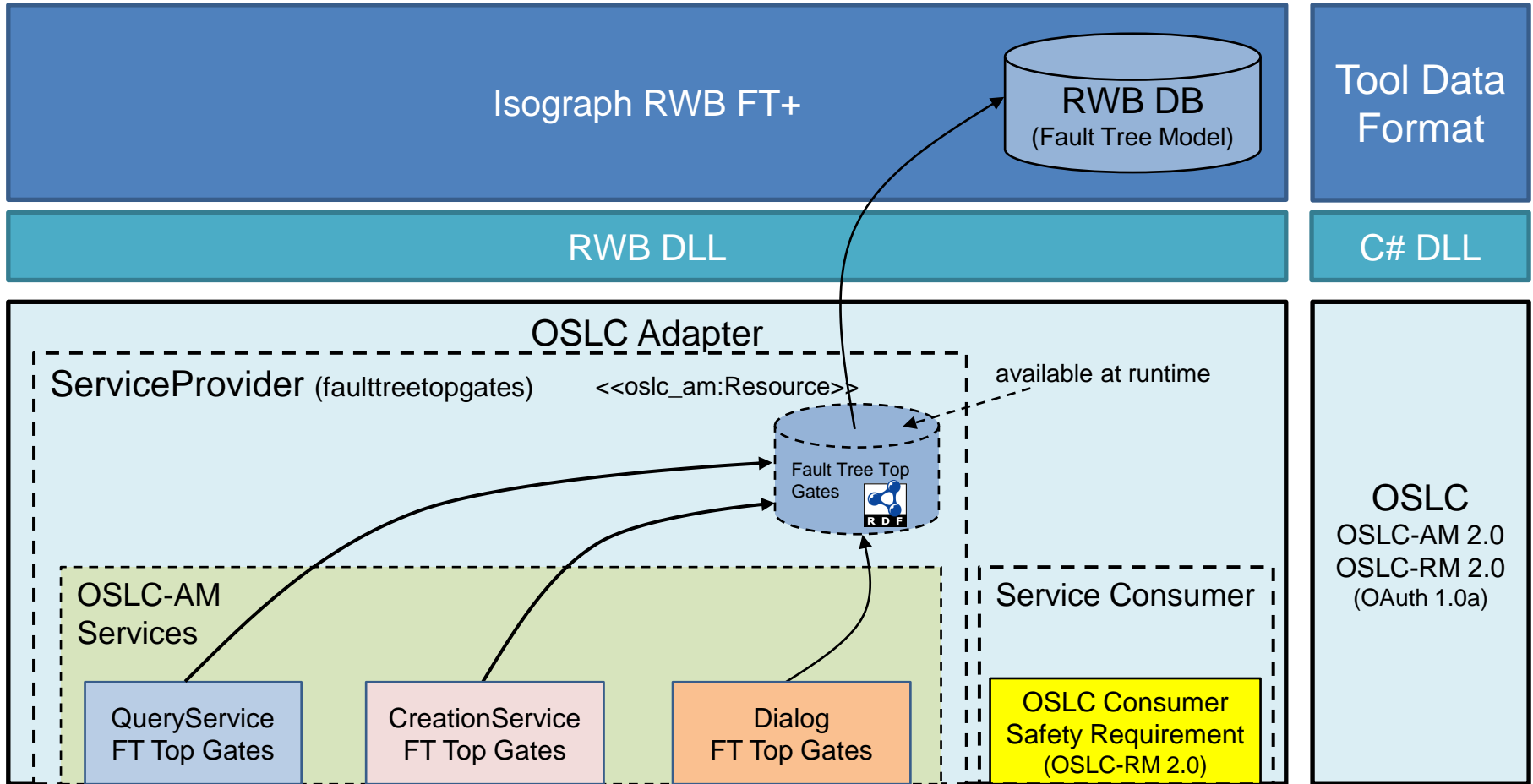
SIL	Low demand mode: average probability of failure on demand	High demand or continuous mode: probability of dangerous failure per hour
1	$\geq 10^{-2}$ to $< 10^{-1}$	$\geq 10^{-6}$ to $< 10^{-5}$
2	$\geq 10^{-3}$ to $< 10^{-2}$	$\geq 10^{-7}$ to $< 10^{-6}$
3	$\geq 10^{-4}$ to $< 10^{-3}$	$\geq 10^{-8}$ to $< 10^{-7}$
4	$\geq 10^{-5}$ to $< 10^{-4}$	$\geq 10^{-9}$ to $< 10^{-8}$

Relationship Safety Requirement and Top Level Event (SAE ARP4761)

D.8.2 Review Design Description/Requirement Documentation:

The analyst should gather all existing system data and analyze it to determine the possible failure events and combinations which could lead to the **top level event** for that particular tree. Possible sources include the system architecture description documents, the various system, hardware, and software design specifications and description documents, and the designer/analyst's own intimate knowledge of the system.

Technical Solution Illustration (3) (ServiceProvider and Services Implementation for RWB FaultTree+)

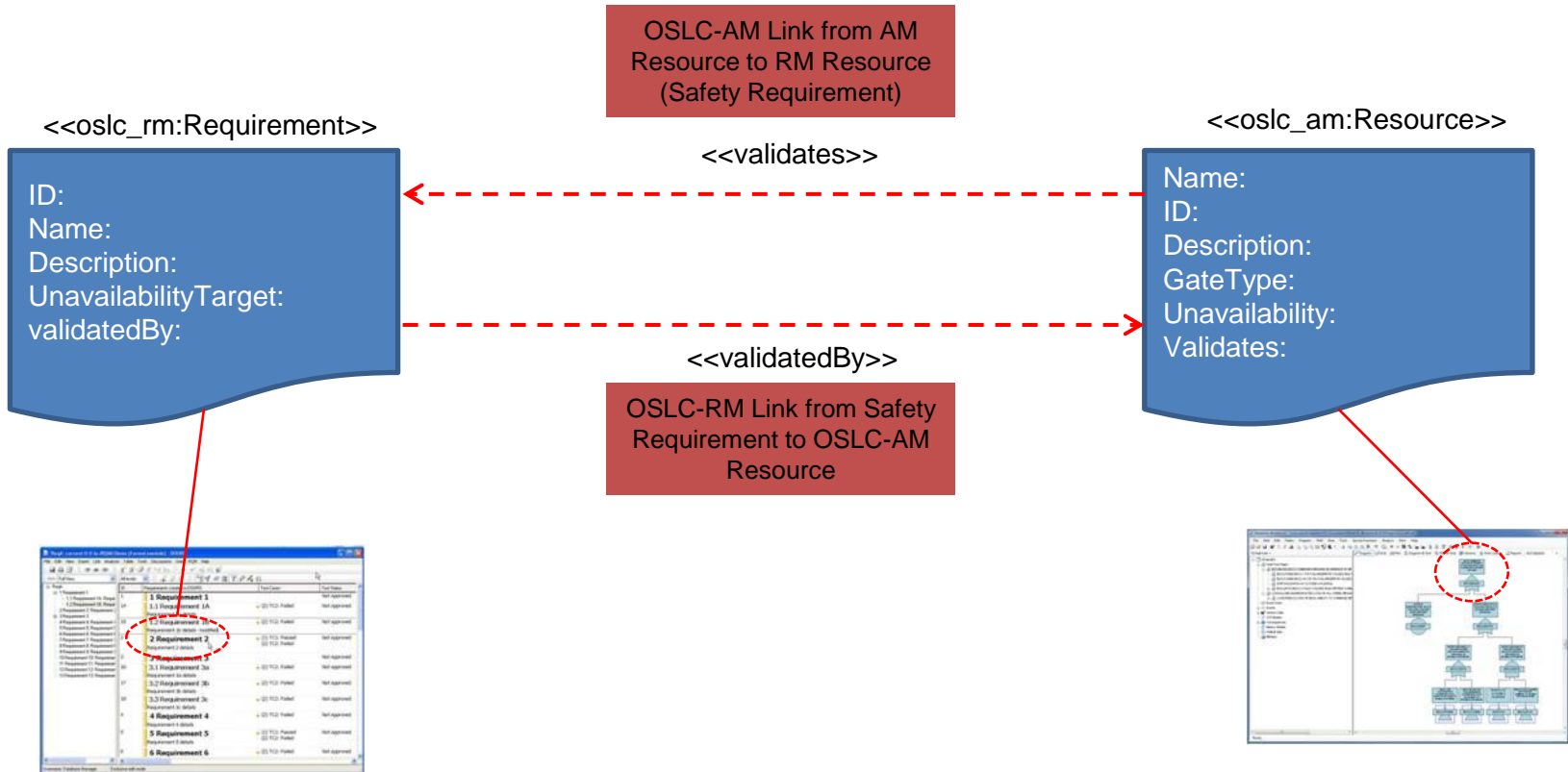


Technical Solution Illustration (4) (Relationship Safety Requirements and Fault Tree Model)

DOORS 9.4

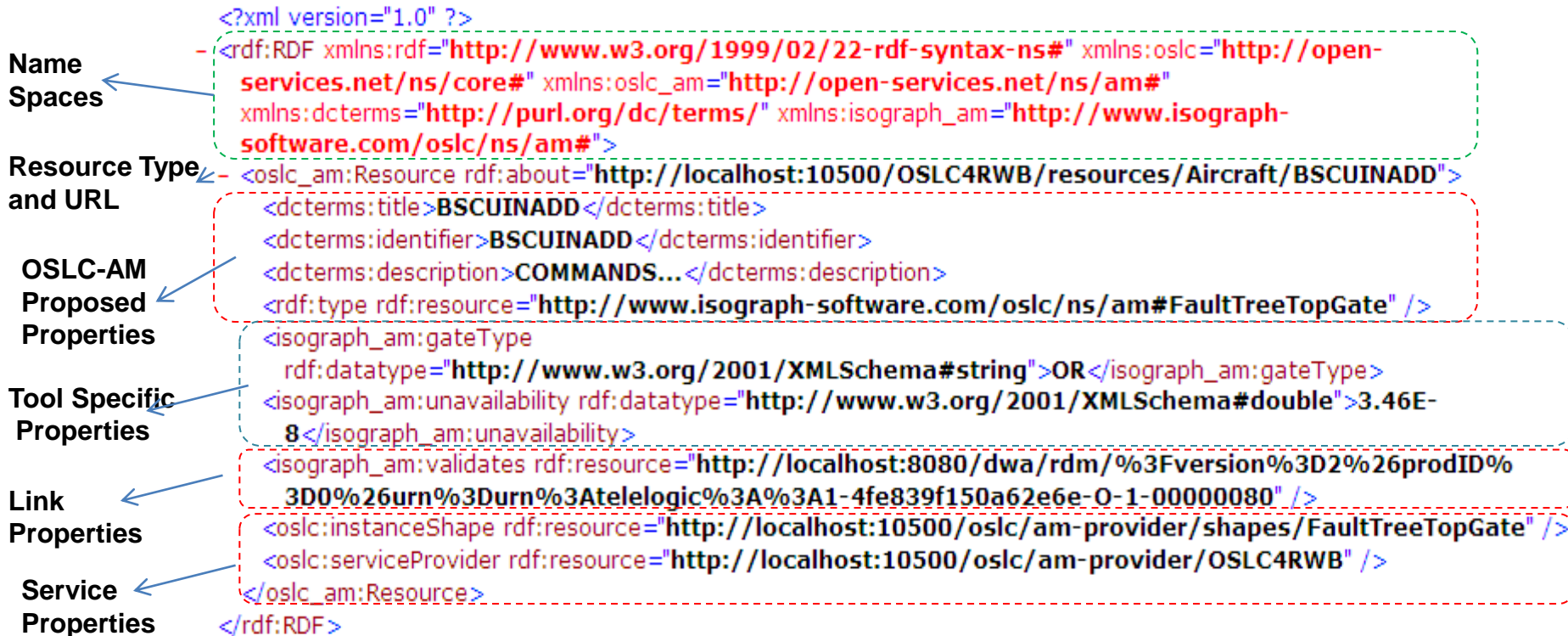
Aircraft wheel braking system safety requirements

Isograph RWB FaultTree+
Aircraft wheel braking system fault tree project



ISOGRAPH SOLUTION FOR OSLC RESOURCE DEFINITION

OSLC AM Resource Example



More detailed description on the following slides!

OSLC AM Resource Example

[1] Name Spaces, Resource Type and URL

```
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:oslc="http://open-services.net/ns/core#"
xmlns:oslc_am="http://open-services.net/ns/am#"
xmlns:dcterms="http://purl.org/dc/terms/"
```

Enter **default** XML name spaces needed for your resource. See also W3C XML NameSpace or MBAT IOS for further information.

```
xmlns:isograph_am="http://www.isograph-software.com/oslc/ns/am#">
```

Enter **specific** XML name spaces needed for your resource to use additional Resource Types and Properties
Note: The link guides the user to a website listing all terms!

```
- <oslc_am:Resource rdf:about="http://localhost:10500/OSLC4RWB/resources/Aircraft/BSCUINADD">
```

OSLC Resource Type. Please just use the following:

[oslc_am:Resource](#), [oslc_am:LinkType](#)
[oslc_rm:Requirement](#), [oslc_rm:RequirementCollection](#)
[oslc_qm:TestPlan](#), [oslc_qm:TestCase](#), [oslc_qm:TestScript](#),
[oslc_qm:TestExecutionRecord](#), [oslc_qm:TestResult](#)

Unique Identifier for a resource -
this needs to be unique inside the
whole project space

OSLC AM Resource Example

[2] OSLC-AM Proposed properties

Each OSLC specification proposes a number of properties for its Resource Types.
We propose to use at least “title, identifier, description”

```
<dcterms:title>BSCUINADD</dcterms:title>  
<dcterms:identifier>BSCUINADD</dcterms:identifier>  
<dcterms:description>COMMANDS...</dcterms:description>  
<rdf:type rdf:resource="http://www.isograph-software.com/oslc/ns/am#FaultTreeTopGate" />
```

Prefix Name	Occurs	Read-only	Value-type	Representation	Range	Description
dcterms:title	exactly-one	unspecified	XMLLiteral	n/a	n/a	Title (reference: Dublin Core) of the resource represented as rich text in XHTML content. Short name identifying a resource, often used as an abbreviated identifier for presentation to end-users. SHOULD include only content that is valid inside an XHTML element.
rdf:type	zero-or-many	unspecified	Resource	Reference	n/a	The resource type URIs. If the resource is not in the form where the XML element defines the <code>rdf:type</code> of the resource (i.e. uses <code>rdf:Description</code> instead of <code>oslc_am:Resource</code>) then a <code>rdf:type</code> element with a value of <code>http://open-services.net/ns/am#Resource</code> is required to type the resource.
dcterms:identifier	exactly-one	unspecified	String	n/a	n/a	A unique identifier for a resource. Assigned by the service provider when a resource is created. Not intended for end-user display.
dcterms:description	zero-or-one	unspecified	XMLLiteral	n/a	n/a	Descriptive text (reference: Dublin Core) about resource represented as rich text in XHTML content. SHOULD include only content that is valid and suitable inside an XHTML <div> element.

OSLC AM Resource Example

[3] Tool Specific Properties

Add any property on top of the default proposed ones which is important to share with others.
Note: Do not try to add all possible properties. Just the important ones. The intention by sharing resources is not to do model transformation/translation...

```
<isograph_am:gateType rdf:datatype="http://www.w3.org/2001/XMLSchema#string">OR</isograph_am:gateType>  
<isograph_am:unavailability rdf:datatype="http://www.w3.org/2001/XMLSchema#double">3.46E-8</isograph_am:unavailability>
```

Prefix Name	Occurs	Read-Only	Value-Type	Description
gateType	Zero-or-one	unspecified	XMLLiteral	The type of a gate in Isograph RWB FT+ can be either OR, AND, VOTE, NOT, XOR, INHIBIT, PRIORITY, TRANSFER or NULL
unavailability	Zero-or-one	unspecified	XMLLiteral	Unavailability can be defined as the probability that an item will not operate correctly at a given time and under specified conditions. It opposes availability.

OSLC AM Resource Example

[4] Link Properties

The linking of resources using link types allows us to implement traceability!

Links should be bi-directional (e.g. an Requirement is “validatedBy” a Test Case and a Test Case “validates” a Requirement)

The different OSLC Specification already propose some types called “**Relationship properties**”, see specifications!

```
<isograph_am:validates rdf:resource="http://localhost:8080/dwa/rdm/%3Fversion%3D2%26prodID%3D0%26urn%3Durn%3Aatelelogic%3A%3A1-4fe839f150a62e6e-O-1-00000080" />
```

URL to an oslc_rm:Requirements Resource shared by a requirements management tool (here DOORS 9.4)

In this example a proprietary Relationship properties is defined in the Shape and used in the resource.

Prefix Name	Occurs	Read-Only	Value-Type	Description
validates	Zero-or-many	unspecified	Resource	Link to RM resource which is validated by this AM resource.

OSLC AM Resource Example

[5] Service Properties

Additional properties can be used to provide information and support to the user like which service provider is responsible a resource or what shape support the user to understand the resource and its properties.

I call this properties “Service Properties”. If you find another definition, please let me know

```
<oslc:instanceShape rdf:resource="http://localhost:10500/oslc/am-provider/shapes/FaultTreeTopGate" />  
<oslc:serviceProvider rdf:resource="http://localhost:10500/oslc/am-provider/OSLC4RWB" />
```

Prefix Name	Occurs	Read-Only	Value-Type	Description
oslc:instanceShape	zero-or-one	true	Resource	Resource Shape that provides hints as to resource property value-types and allowed values.
oslc:serviceProvider	zero-or-many	true	Resource	The scope of a resource is a link to the resource's OSLC Service Provider.

OSLC AM ResourceShape Example

The OSLC ResourceShapes are used as “data model” or “information” description.

A Shape describes a resource type and its properties.

They should just support users to understand your data!

For Shape definition see Core Specification:

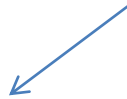
- <http://open-services.net/bin/view/Main/OSLCCoreSpecAppendixA>
- ResourceShape: Default representation of a resource: Property A is read-only
- InstanceShape: Runtime representation of a resource: Property A can be modified
- Presentation in HTML for humans, Presentation in RDF for machines

OSLC AM ResourceShape Example

[1] The Resource Type

The “basic” type of the resources are always OSLC Resource types from the RM, AM or QM specifications!

URL to your ResourceShape RDF



```
<oslc:ResourceShape rdf:about="http://www.isograph-software.com/oslc/am-provider/shapes/FaultTreeTopGate">  
  <dcterms:title>AM Fault Tree Top Gate Resource Shape</dcterms:title>  
  <oslc:describes rdf:resource="http://open-services.net/ns/am#Resource" />
```



Basic OSLC-X type of your Resource

OSLC AM ResourceShape Example

[2] The default proposed properties

```
<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Title</dcterms:title>
    <oslc:name>title</oslc:name>
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Exactly-one" />
    <oslc:propertyDefinition rdf:resource="http://purl.org/dc/terms/title" />
    <oslc:valueType rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral" />
  </oslc:Property>
</oslc:property>

<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Type</dcterms:title>
    <oslc:name>type</oslc:name>
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#One-or-many" />
    <oslc:propertyDefinition rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#type" />
    <oslc:valueType rdf:resource="http://open-services.net/ns/core#Resource" />
    <oslc:representation rdf:resource="http://open-services.net/ns/core#Reference" />
  </oslc:Property>
</oslc:property>

<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Identifier</dcterms:title>
    <oslc:name>identifier</oslc:name>
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Exactly-one" />
    <oslc:propertyDefinition rdf:resource="http://purl.org/dc/terms/identifier" />
    <oslc:valueType rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
  </oslc:Property>
</oslc:property>

<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Description</dcterms:title>
    <oslc:name>description</oslc:name>
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Zero-or-one" />
    <oslc:propertyDefinition rdf:resource="http://purl.org/dc/terms/description" />
    <oslc:valueType rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#XMLLiteral" />
  </oslc:Property>
</oslc:property>
```

Each OSLC specification proposes a number of properties for its Resource Types.

We propose to use at least “title, identifier, description”

OSLC AM ResourceShape Example

[3] The tool specific properties

Add additional properties based on your tool or use case.

```
<!--Isograph or Project specific Fault Tree Top Gate Attributes, Note a "top gate" is similar to a "top level event" as defined by
<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Gate Type</dcterms:title>
    <oslc:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string">gateType</oslc:name>
    <dcterms:description rdf:parseType="Literal">The type of a gate in Isograph RWB FT+ can be either OR, AND, VOTE, NOT, XOR,
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Zero-or-one" />
    <oslc:propertyDefinition rdf:resource="http://www.isograph-software.com/oslc/am-provider/terms/gatetype" />
    <oslc:valueType rdf:resource="http://www.w3.org/2001/XMLSchema#string" />
  </oslc:Property>
</oslc:property>

<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Unavailability</dcterms:title> <!-- SIL or Failure Probability -->
    <oslc:name rdf:datatype="http://www.w3.org/2001/XMLSchema#double">Unavailability</oslc:name>
    <dcterms:description rdf:parseType="Literal">Unavailability can be defined as the probability that an item will not operate
    <oslc:defaultValue rdf:datatype="http://www.w3.org/2001/XMLSchema#double">0.0</oslc:defaultValue>
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Zero-or-one" />
    <oslc:propertyDefinition rdf:resource="http://www.isograph-software.com/oslc/am-provider/terms/FaultTree/Unavailability" />
    <oslc:valueType rdf:resource="http://www.w3.org/2001/XMLSchema#double" />
  </oslc:Property>
</oslc:property>
```

OSLC AM ResourceShape Example

[4] Link Types

Create link types or reuse ones proposed by the OSLC specifications called **Relationship properties**

Note: The ValueType is always a Resource!

```
<oslc:property>
  <oslc:Property> <!-- The RM resource contains the corresponding validatedBy link? -->
    <oslc:name>validates</oslc:name>
    <dcterms:title rdf:parseType="Literal">Validates</dcterms:title>
    <oslc:propertyDefinition rdf:resource="http://www.isograph-software.com/oslc/am-provider/terms/validates" />
    <dcterms:description rdf:parseType="Literal">Link to RM resource which is validated by this RM resource.</dcterms:description>
    <oslc:readOnly>false</oslc:readOnly>
    <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:representation rdf:resource="http://open-services.net/ns/core#Reference" />
    <oslc:valueType rdf:resource="http://open-services.net/ns/core#Resource" />
  </oslc:Property>
</oslc:property>
```

OSLC AM ResourceShape Example

[5] Service Properties

In some cases users may access or receive resources and wants to perform an action on them. In this case additional properties can be used to provide information and support to the user like which service provider is responsible for the Resource or which Shape specifies a Resource and its properties.

```
<!-- Support Attributes -->
<oslc:property>
  <oslc:Property><!-- Instance Shape, Value Shape or Resource Shape? -->
    <dcterms:title rdf:parseType="Literal">Instance Shape</dcterms:title>
    <oslc:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string">instanceShape</oslc:name>
    <oslc:representation rdf:resource="http://open-service.net/ns/core#Reference" />
    <oslc:valueType rdf:resource="http://open-services.net/ns/core#Resource" />
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Zero-or-one" />
    <oslc:propertyDefinition rdf:resource="http://open-services.net/ns/core#instanceShape" />
    <dcterms:description rdf:parseType="Literal">Resource Shape of the Isograph Fault Tree Top Gate object</dcterms:description>
    <oslc:readOnly rdf:datatype="http://www.w3.org/2001/XMLSchema#boolean">true</oslc:readOnly>
    <oslc:valueShape rdf:resource="http://open-services.net/ns/core#ResourceShape" />
  </oslc:Property>
</oslc:property>

<oslc:property>
  <oslc:Property>
    <dcterms:title rdf:parseType="Literal">Service Provider</dcterms:title>
    <oslc:representation rdf:resource="http://open-service.net/ns/core#Reference" />
    <dcterms:description rdf:parseType="Literal">Associated resource provider</dcterms:description>
    <oslc:propertyDefinition rdf:resource="http://open-services.net/ns/core#serviceProvider" />
    <oslc:valueShape rdf:resource="http://open-services.net/ns/core#ServiceProvider" />
    <oslc:occurs rdf:resource="http://open-services.net/ns/core#Zero-or-many" />
    <oslc:readOnly rdf:datatype="http://www.w3.org/2001/XMLSchema#boolean">true</oslc:readOnly>
    <oslc:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string">serviceProvider</oslc:name>
    <oslc:valueType rdf:resource="http://open-services.net/ns/core#Resource" />
  </oslc:Property>
</oslc:property>
</oslc:ResourceShape>
```

End of our ResourceShape

Discussion on XML namespace for OMG SysML 1.3

Different Version of an vocabulary (e.g. from v1.3 to 1.4)

→ Proposal 1: avoid version numbers in the URL e.g.:

www.x.com/oslc4mbse/sysml/ns/am#