*Secure Provisioning of Cloud Services
based on SLA Management*

# SPECS Project - Deliverable 2.3.3

# Module Interaction Protocols
# Annex A – Evaluation API

Version no. 1.0
30 April 2016

# Table of contents

## Index of tables

In this annex, we present the Evaluation API, offered by the Security Reasoner. The API includes functionalities invoked by the Supply Chain Manager in the SPECS flow, but also offers functionalities to the SPECS Owner for the evaluation of providers and their comparison.

The REST resources and related calls associated with such API are illustrated in the following.

# 1. Evaluation API Resources

The Evaluation API supports the resources described in the following structure, adopted in all annexes:

• The *Resource* column simply reports a significant name for the resources.

• The *Type* column describes the type of resource: allowed types are collections (managed according to the guidelines) or objects.

• The *Description* column offers a brief description of the resource, while the *Base URI* column reports the URI identifier used to access the resource.

| Resource | Type | Description | Base URI |
|---|---|---|---|
| **Caiqs** | Collection | The collection of Caiqs maintained by the system | /specs-app-SecurityReasoner/caiqs |
| **Caiq** | Object | A Caiq maintained by the system | /specs-app-SecurityReasoner/caiqs/{id} |
| **Judgements** | Collection | The collection of judgements associated with a given SLA | /specs-app-SecurityReasoner/judgements |
| **Judgement** | Object | A Judgement maintained by the system | /specs-app-SecurityReasoner/judgements/{judgement-id} |
| **SLACaiqs** | Collection | The collection of SLACaiq maintained by the system | /specs-app-SecurityReasoner/slacaiqs |
| **SlaCaiq** | Object | A SLACaiq maintained by the system | /specs-app-SecurityReasoner/slacaiqs/{id-slacaiq}/score |

**Table 1. Evaluation API resources**

# 2. Evaluation API Calls

In the following tables, we present the set of REST calls associated with the Evaluation API. For each call, we report the resource URI (i.e., the call path) and the applicable HTTP methods, along with other relevant information (including the request and response bodies and the semantics of response codes when different from the ones discussed in D1.3).

| Resource URI | /specs-app-SecurityReasoner/caiqs | |
|---|---|---|
| **GET** | *Description* | It returns the available collection of Caiqs if no query string has been specified. Otherwise, it returns up to an "items" number of items, or "length" items starting from item with index "page". |
| | *Query String* | • Not present<br>• items={num_items}<br>• page={first_item}&length={len} |
| | *Request Body* | Empty |
| | *Response Body* | Media type:<br>• Application/json<br>http://www.specs-project.eu/resources/schemas/json/collections.json<br>(Collection JSON description) |
| | *Response Codes Semantics* | |
| | *Notes* | |
| **POST** | *Description* | It adds a new valid Caiq (specified in the XML format) to the set of Caiqs, and returns the URI of the created resource. The new structure created will contain a reference to the stored xml document, and the related CSP name. |
| | *Query String* | Not supported |
| | *Request Body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/caiqtemplate.xsd<br>(CAIQ XML description) |
| | *Response Body* | Media type:<br>✓ Text/plain<br>Resource URI of the created Caiq Resource |
| | *Response Codes Semantics* | • *201 Created:* the Caiq resource has been correctly created<br>• *435 Invalid Input: request body not compliant with the defined schema.* |
| | *Notes* | |

| Resource URI | **/specs-app-SecurityReasoner/caiqs /{caiq-id}** | |
|---|---|---|
| **GET** | *Description* | It retrieves the Caiq identified by the Caiq-id parameter. |
| | *Query string* | Not supported |
| | *Request body* | • Not present |
| | *Response body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/caiqwrapper.xsd<br>(Caiq Wrapper XML description) |
| | *Response Codes Semantics* | • *404 Not Found: the* Caiq resource requested is not available. |
| | *Notes* | |
| **PUT** | *Description* | It updates the Caiq identified by the Caiq-id parameter, stores a new Caiq document, and removes the old one, together with its weighted and evaluated trees. |
| | *Query string* | Not supported |
| | *Request body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/caiqtemplate.xsd<br>(CAIQ XML description) |
| | *Response body* | Empty |
| | *Response Codes Semantics* | • *200 OK*<br>• *404 Not Found: the specified Caiq has not been found.*<br>• *435 Invalid Input:* request body not compliant with the defined schema. |
| | *Notes* | |
| **DELETE** | *Description* | It deletes the Caiq identified by the Caiq-id parameter, together with its weighted and evaluated trees. |
| | *Query string* | Not supported |
| | *Request body* | Empty |
| | *Response body* | Empty |
| | *Response Codes Semantics* | • *204 No Content:* the Caiq has been deleted.<br>• *404 Not Found:* the specified Caiq has not been found. |
| | *Notes* | |

| Resource URI | / specs-app-SecurityReasoner/caiqs /{caiq-id}/associate | |
|---|---|---|
| **POST** | *Description* | It creates a weighted tree, using the Caiq identified by Caiq-id and the judgement identified by idJudgement. A structure containing a judgement id, a weighted tree and its state (set to "weighted") is added to the Caiq. |
| | *Query string* | Not supported |
| | *Request body* | Text Plain: <ul><li>idJudgement</li></ul> |
| | *Response body* | Text Plain: <ul><li>idJudgement</li></ul> |
| | *Response Codes Semantics* | <ul><li>*422 Unprocessable Entity:* the specified judgement has not been found.</li><li>*404 Not Found:* the specified Caiq has not been found.</li><li>*201 Created:* the weighted tree has been correctly created.</li></ul> |
| | *Notes* | |

| Resource URI | / specs-app-SecurityReasoner/caiqs /{caiq-id}/evaluate | |
|---|---|---|
| **GET** | *Description* | It evaluates the Caiq identified by Caiq-id, using the default judgement if no query string has been specified. Otherwise, it evaluates the Caiq using the judgement specified by the idJudgement parameter. |
| | *Query String* | <ul><li>Not present</li><li>idJudgement = id</li></ul> |
| | *Request Body* | Empty |
| | *Response Body* | <ul><li>Application/xml http://www.specs-project.eu/resources/schemas/xml/caiqtree.xsd</li><li>(Evaluated Caiq XML description)</li></ul> |
| | *Response Codes Semantics* | <ul><li>*201 Created:* the Caiq has been correctly evaluated.</li><li>*409 Conflict:* the Judgement suggested is not yet associated to this Caiq.</li></ul> |
| | *Notes* | |

| Resource URI | **/specs-app-SecurityReasoner/judgements** | |
|---|---|---|
| **GET** | *Description* | It returns the available collection of judgements if no query string has been specified. Otherwise, it returns up to an "items" number of items, or "length" items starting from item with index "page". |
| | *Query String* | • Not present<br>• items={num_items}<br>• page={first_item}&length={len} |
| | *Request Body* | Empty |
| | *Response Body* | Media type:<br>✓ Application/json<br>http://www.specs-project.eu/resources/schemas/json/collections.json<br>(Collection JSON description) |
| | *Response Codes Semantics* | |
| | *Notes* | |
| **POST** | *Description* | It adds a new valid judgement (specified in the XML format) to the set of judgements, and returns the URI of the created resource. |
| | *Query String* | Not supported |
| | *Request Body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/judgementtemplate.xsd<br>(Judgement XML description) |
| | *Response Body* | Media type:<br>✓ Text/plain<br>Resource URI of the created Judgement Resource |
| | *Response Codes Semantics* | • *201 Created:* the Judgement resource has been correctly created<br>• *435 Invalid Input: request body not compliant with the defined schema.* |
| | *Notes* | |

| Resource URI | **/specs-app-SecurityReasoner/judgements/{judgement-id}** | |
|---|---|---|
| **GET** | *Description* | It retrieves the judgement identified by the judgement -id parameter. |
| | *Query string* | Not supported |
| | *Request body* | Empty |
| | *Response body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/judgementwrapper.xsd<br>(Judgement Wrapper XML description) |
| | *Response Codes Semantics* | • *200 OK*<br>• *404 Not Found: the* Judgement resource requested is not available. |
| | *Notes* | |
| **PUT** | *Description* | It updates the judgement identified by the judgement -id parameter, only if the previous version is not associated to any Caiq. |
| | *Query string* | Not supported |
| | *Request body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/judgementtemplate.xsd<br>(Judgement XML description) |
| | *Response body* | Empty |
| | *Response Codes Semantics* | • *200 OK*<br>• *404 Not Found:* the specified judgement has not been found*.*<br>• *435 Invalid Input:* request body not compliant with the defined schema.<br>• *409 Conflict:* this judgement is already associated to a Caiq. |
| | *Notes* | |
| **DELETE** | *Description* | It deletes the judgement identified by the judgement-id parameter, together with all weighted/evaluated trees associated to it. The default judgement cannot be deleted. |
| | *Query string* | Not supported |
| | *Request body* | Empty |
| | *Response body* | Empty |
| | *Response Codes Semantics* | • *204 No Content:* the judgement has been deleted.<br>• *404 Not Found:* the specified judgement has not been found.<br>• *409 Conflict:* cannot delete the default judgement*.* |
| | *Notes* | |

| Resource URI | **/specs-app-SecurityReasoner/slacaiqs** | |
|---|---|---|
| **GET** | *Description* | It returns a collection of SLACaiq, ordered by their root score. |
| | *Query String* | • Not present<br>• items={num_items}<br>• page={first_item}&length={len} |
| | *Request Body* | Empty |
| | *Response Body* | Media type:<br>• Application/json<br>http://www.specs-project.eu/resources/schemas/json/collections.json<br>(Collection JSON description) |
| | *Response Codes Semantics* | |
| | *Notes* | |
| **POST** | *Description* | It adds a new SLACaiq to the collection of available SLACaiq, and returns the URI of the created resource.<br>(See Notes) |
| | *Query String* | Not supported |
| | *Request Body* | Media type:<br>• Application/xml<br>http://www.specs-project.eu/resources/schemas/xml/SLAtemplate.xsd<br>(SLA XML description) |
| | *Response Body* | Media type:<br>✓ Text/plain<br>Resource URI of the created SLACaiq |
| | *Response Codes Semantics* | ✓ *201 Created:* the SLACaiq has been correctly created<br>✓ *435 Invalid Input:* request body not compliant with the defined schema<br>✓ *409 Conflict:* System not initialized (no default judgement defined).<br>✓ *404 Not found:* The call cannot be completed, due to the absence of the related caiq. |
| | *Notes* | *The calls retrieves, modifies and evaluates the Caiq of the Cloud Service Provider specified in the SLA.* |


| Resource URI | **/specs-app-SecurityReasoner/slacaiqs/{id-slacaiq}/score** | |
|---|---|---|
| **GET** | *Description* | It returns the root score of the specified SLACaiq if no query string is specified. Otherwise it returns the score of the requested category. |
| | *Query String* | • Not present<br>• Category = category |
| | *Request Body* | Empty |

| | | |
|---|---|---|
| | *Response Body* | Media type:<br>✓ Text/Plain<br>  (Score requested) |
| | *Response Codes Semantics* | ✓ *200 OK:* the  SLACaiq has been correctly retrieved<br>✓ *404 Not found:* The call cannot be completed, due to the absence of the related SLACaiq.<br>✓ *404 Not found:* The call cannot be completed, due to the absence of the requested category. |
| | *Notes* | |

# 3. Evaluation API Data models

In this section, we provide the data models adopted by the Evaluation API and specified in the previous section as part of the documentation of each Evaluation API call. Apart from the data model of collections, described in the deliverable, and from the data model of the SLA, which is fully explained in D2.2.2, the SLA API calls rely upon the following data models:

- CAIQ Template
- CAIQ Wrapper
- Judgment Template
- Judgement Wrapper
- Evaluated Caiq Template

## *4.1.     CAIQ  Template data model*

The CAIQ Template data model represents a description of the CAIQ. In Table 2  we report the XML schema, available at [xml_1].

| Format | Data model |
|---|---|
| XML | <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt;<br>&lt;schema xmlns="http://www.w3.org/2001/XMLSchema" targetNamespace="ValueTree"<br>xmlns:tns="ValueTree"&gt;<br><br>        &lt;element name="ValueTree"&gt;<br>         &lt;complexType&gt;<br>           &lt;sequence&gt;<br>            &lt;element name="Root" type="tns:RootType" minOccurs="1"<br>maxOccurs="1"&gt;<br>            &lt;/element&gt;<br>           &lt;/sequence&gt;<br>         &lt;/complexType&gt;<br>        &lt;/element&gt;<br><br>     &lt;complexType name="IdType" abstract="true"&gt;<br>        &lt;attribute name="Id" type="string"/&gt;<br>        &lt;/complexType&gt;<br><br>        &lt;complexType name="extendedIdType" abstract="true"&gt;<br>        &lt;attribute name="Id" type="string"/&gt;<br>        &lt;attribute name="Question" type="string"/&gt;<br>        &lt;attribute name="Answer" type="string"/&gt;<br>        &lt;/complexType&gt;<br><br>        &lt;complexType name="RootType"&gt;<br>              &lt;complexContent&gt;<br>        &lt;extension base="tns:IdType"&gt;<br>              &lt;sequence&gt;<br>              &lt;element name="ValueNode" type="tns:FirstValueNodeType"<br>minOccurs="1" maxOccurs="unbounded"&gt;&lt;/element&gt;<br>              &lt;/sequence&gt;<br>        &lt;/extension&gt;<br>        &lt;/complexContent&gt;<br>     &lt;/complexType&gt;<br><br>        &lt;complexType name="FirstValueNodeType"&gt;<br>        &lt;complexContent&gt;<br>        &lt;extension base="tns:IdType"&gt;<br>              &lt;sequence&gt;<br>                        &lt;element name="ValueNode"<br>type="tns:SecondValueNodeType" minOccurs="1" maxOccurs="unbounded"&gt;&lt;/element&gt;<br>        &lt;/sequence&gt;<br>        &lt;/extension&gt;</pre> |

```
                </complexContent>
        </complexType>

        <complexType name="SecondValueNodeType" >
          <complexContent>
          <extension base="tns:IdType">
                <sequence>
                        <element name="ValueNode" type="tns:ValueType"
minOccurs="1" maxOccurs="unbounded"></element>
                </sequence>
          </extension>
          </complexContent>
        </complexType>

        <complexType name="ValueType" >
          <complexContent>
          <extension base="tns:extendedIdType">
                <sequence>
                        <element name="Value" type="string" minOccurs="1"
maxOccurs="1"></element>
                </sequence>
          </extension>
          </complexContent>
        </complexType>

</schema>
```

**Table 2. Caiq template data model**

## 4.2.    CAIQ  Wrapper data model

The CAIQ Wrapper data model represents a description of the Caiq metadata. In Table 3  we report the XML schema, available at [xml_2].

| Format | Data model |
|---|---|
| XML | <xs:schema<br>        targetNamespace="http://www.specs-<br>project.eu/resources/schemas/xml/CaiqResourceTemplate"<br>        xmlns:xs="http://www.w3.org/2001/XMLSchema"><br>        <xs:element name="caiq"><br>                <xs:complexType><br>                        <xs:sequence><br>                                <xs:element type="xs:string" name="CSP" /><br>                                <xs:element type="xs:string" name="documentId" /><br>                                <xs:element name="associations"><br>                                        <xs:complexType><br>                                                <xs:sequence><br>                                                        <xs:element name="association"<br>maxOccurs="unbounded"<br>                                                                minOccurs="0"><br>                                                        <xs:complexType><br>                                                                <xs:sequence><br>                                                                        <xs:element<br>type="xs:string" name="idJudgement" /><br>                                                                        <xs:element<br>type="xs:string" name="idTree" /><br>                                                                        <xs:element<br>type="xs:string" name="state" /><br>                                                                </xs:sequence><br>                                                        </xs:complexType><br>                                                </xs:element><br>                                                </xs:sequence><br>                                        </xs:complexType><br>                                </xs:element><br>                        </xs:sequence><br>                        <xs:attribute type="xs:string" name="id" /> |

```
                              </xs:complexType>
                    </xs:element>
          </xs:schema>c
```

**Table 3. Caiq wrapper data model**

### *4.3.    Judgement Template data model*

The Judgement Template data model represents a description of the Judgement. In Table 4 we report the XML schema, available at [xml 3].

| Format | Data model |
|--------|------------|
| XML | <?xml version="1.0" encoding="UTF-8"?><br><schema xmlns="http://www.w3.org/2001/XMLSchema"<br>targetNamespace="WeightsSimple"<br>    xmlns:tns="WeightsSimple"><br><br>    <element name="WeightsSimple"><br>        <complexType><br>            <sequence><br>                <element name="Root" type="tns:RootType" minOccurs="1"<br>                    maxOccurs="1"><br>                </element><br>            </sequence><br>        </complexType><br>    </element><br><br>    <complexType name="IdType" abstract="true"><br>        <attribute name="Id" type="string" /><br>        <attribute name="SimpleJudgment" type="string" /><br>    </complexType><br><br>    <complexType name="RootType"><br>        <complexContent><br>            <extension base="tns:IdType"><br>                <sequence><br>                    <element name="SimpleJudgmentNode" type="tns:FirstSimpleJudgmentNodeType"<br>                        minOccurs="1" maxOccurs="unbounded"></element><br>                </sequence><br>            </extension><br>        </complexContent><br>    </complexType><br><br>    <complexType name="FirstSimpleJudgmentNodeType"><br>        <complexContent><br>            <extension base="tns:IdType"><br>                <sequence><br>                    <element name="SimpleJudgmentNode" type="tns:SecondSimpleJudgmentNodeType"<br>                        minOccurs="1" maxOccurs="unbounded"></element><br>                </sequence><br>            </extension><br>        </complexContent><br>    </complexType><br><br>    <complexType name="SecondSimpleJudgmentNodeType"><br>        <complexContent><br>            <extension base="tns:IdType"><br>                <sequence><br>                    <element name="SimpleJudgmentNode" type="tns:SimpleJudgmentType"<br>                        minOccurs="1" maxOccurs="unbounded"></element><br>                </sequence> |

```
                        </extension>
                </complexContent>
        </complexType>

        <complexType name="SimpleJudgmentType">
                <complexContent>
                        <extension base="tns:IdType">

                        </extension>
                </complexContent>
        </complexType>

</schema>
```

**Table 4. Judgement template data model**

## 4.4.    *Judgement Wrapper data model*

The Judgement Wrapper data model represents a description of the Judgement metadata. In Table 5 we report the XML schema, available at [xml 4].

| Format | Data model |
|---|---|
| XML | ```<xs:schema
        targetNamespace="http://www.specs-
project.eu/resources/schemas/xml/CaiqResourceTemplate"
        xmlns:xs="http://www.w3.org/2001/XMLSchema">
        <xs:element name="judgement">
                <xs:complexType>
                        <xs:sequence>
                                <xs:element type="xs:string"
name="judgementXmlDocument" />
                        </xs:sequence>
                        <xs:attribute type="xs:string" name="default" />
                        <xs:attribute type="xs:string" name="id" />
                </xs:complexType>
        </xs:element>
</xs:schema>``` |

**Table 5. Judgement wrapper data model**

## 4.5.    *Evaluated Caiq Template data model*

The Judgement Template data model represents a description of the Judgement. In Table 6 we report the XML schema, available at [xml 5].

| Format | Data model |
|---|---|
| XML | ```<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema" targetNamespace="Tree"
        xmlns:tns="Tree">

        <element name="Tree">
                <complexType>
                        <sequence>
                                <element name="Root" type="tns:RootType"
minOccurs="1"
                                        maxOccurs="1">
                                </element>
                        </sequence>
                </complexType>
        </element>

        <complexType name="IdType" abstract="true">
                <attribute name="Id" type="string" />
                <attribute name="sl" type="double" />``` |

```
            </complexType>

        <complexType name="extensionIdType">
                <attribute name="Id" type="string" />
                <attribute name="sl" type="double" />
                <attribute name="weightIncidentEdge" type="double" />
        </complexType>


        <complexType name="RootType">
                <complexContent>
                        <extension base="tns:IdType">
                                <sequence>
                                        <element name="RequirementNode"
type="tns:FirstRequirementNodeType"
                                                minOccurs="1"
maxOccurs="unbounded"></element>
                                </sequence>
                        </extension>
                </complexContent>
        </complexType>

        <complexType name="FirstRequirementNodeType">
                <complexContent>
                        <extension base="tns:extensionIdType">
                                <sequence>
                                        <element name="RequirementNode"
type="tns:SecondRequirementNodeType"
                                                minOccurs="1"
maxOccurs="unbounded"></element>
                                </sequence>
                        </extension>
                </complexContent>
        </complexType>

        <complexType name="SecondRequirementNodeType">
                <complexContent>
                        <extension base="tns:extensionIdType">
                                <sequence>
                                        <element name="RequirementNode"
type="tns:ValueType"
                                                minOccurs="1"
maxOccurs="unbounded"></element>
                                </sequence>
                        </extension>
                </complexContent>
        </complexType>

        <complexType name="ValueType">
                <complexContent>
                        <extension base="tns:extensionIdType">

                        </extension>
                </complexContent>
        </complexType>

</schema>
```

**Table 6. Evaluated Caiq template data model**

# References

xml_1 http://www.specs-project.eu/resources/schemas/xml/caiqtemplate.xsd
xml_2 http://www.specs-project.eu/resources/schemas/xml/caiqwrapper.xsd
xml_3 http://www.specs-project.eu/resources/schemas/xml/judgementtemplate.xsd
xml_4 http://www.specs-project.eu/resources/schemas/xml/judgementwrapper.xsd
xml_5 http://www.specs-project.eu/resources/schemas/xml/caiqtree.xsd