Implementation Type Documentation Requirements for SCA Assembly Model Version 1.1 Specification

Working Draft 02

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Abstract:

This document defines the requirements for the documentation of an SCA implementation type that is used by a conforming SCA Runtime. The documentation describes how implementation artifacts of that implementation type relate to SCA components declared within SCA composites, as described by the SCA Assembly specification

Status:

This document was last revised or approved by the OASIS Service Component Architecture / Assembly (SCA-Assembly) TC on the above date. The level of approval is also listed above. Check the "Latest Version" or "Latest Approved Version" location noted above for possible later revisions of this document.

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1 Introduction

[All text is normative unless otherwise indicated.]

This document defines the content of the documentation that is required to describe an SCA implementation type [SCA-Assembly], where that implementation type is supported by an SCA Runtime that claims to be conforming with the SCA Assembly specification.

The SCA Assembly specification defines an application in terms of service components that use and configure a particular implementation artifact. In order to fully define how a particular service component operates, it is necessary to describe the relationship between the configuration of the SCA component and the implementation technology used by the service component. It is the role of the Implementation Type Documentation to describe this relationship.

Some implementation types are described by formal specifications that have been created by OASIS SCA technical committees. Examples include:

- SCA WS-BPEL Client and Implementation V1.1 [SCA-BPEL]
- SCA POJO Component Implementation V1.1 [SCA-POJO]

1.1 Terminology

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this specification are to be interpreted as described in IETF RFC 2119 [RFC2119].

1.2 Normative References

[RFC 2119] S. Bradner. *Key words for use in RFCs to Indicate Requirement Levels*. IETF RFC 2119, March 1997. http://www.ietf.org/rfc/rfc2119.txt.

[SCA-Assembly] OASIS Committee Draft 05, Service Component Architecture Assembly Model Specification Version 1.1, January 2010. http://docs.oasis-open.org/opencsa/sca-assembly/sca-assembly-1.1-spec-cd05.pdf

[SCA-BPEL] OASIS Committee Draft 02, Service Component Architecture WS-BPEL Client and Implementation Specification Version 1.1, March 2009. http://docs.oasis-open.org/opencsa/sca-bpel/sca-bpel-1.1-spec-cd-02.pdf

[SCA-POJO] OASIS Committee Draft 02, Service Component Architecture POJO Component Implementation Specification Version 1.1, February 2010. http://docs.oasis-open.org/opencsa/sca-j/sca-javaci-1.1-spec-cd02.pdf

[SCA-CPP] OASIS Committee Draft 02, Service Component Architecture Client and Implementation Model for C++ Specification Version 1.1, March 2010. http://docs.oasis-open.org/opencsa/sca-c-cpp/sca-cppcni-1.1-spec-cd05.pdf

1.3 Non-normative References

None

2 Describing an SCA Implementation Type

This document defines the information that is needed for a particular implementation type to be used as a service component implementation within an SCA assembly. The information covers static configuration information required in order to use an implementation type and it's associated artifacts in an SCA assembly and it also covers the dynamic runtime behaviour of instances of the implementation type when the SCA assembly is executed by an SCA Runtime.

While this document gives a general description of the information that needs to be provided for an implementation type, the OASIS SCA technical committees have also produced examples of specifications that provide this same level of information for a variety of implementation technologies. These specifications can provide guidance in creating a document with the appropriate level of information for a new implementation type:

- SCA WS-BPEL Client and Implementation V1.1 [SCA-BPEL], which describes implementations built as WS-BPEL scripts
- SCA POJO Component Implementation V1.1 [SCA-POJO], which describes implementations based on simple Java classes.

What is an Implementation Type?

An implementation type describes how the artifacts of a concrete implementation technology are used to implement SCA components. Implementation types also describe the relationship between a technology specific implementation and the foundational aspects of SCA components, namely services, references, and properties.

Often an implementation type is defined such that it describes all SCA component implementations that use a particular implementation language, such as C++ [SCA-CPP] or BPEL [SCA-BPEL]. However, SCA is flexible and allows multiple implementation types to use the same implementation language. Examples of this occur with the Java language, where implementation types exist for POJO classes [SCA-POJO], for EJBs [SCA-JEE] and for Spring classes [SCA-SPRING]. As a result, the implementation type can represent a specialized form of an implementation technology, where the specialization may involve the use of specific APIs, frameworks or specific language extensions.

How an Implementation is used in SCA

SCA describes applications in terms of assemblies of service components. Service components are declared within SCA composites. Every component must use an implementation - which is expressed as a reference to an artifact that provides a runtime implementation of the service component contract.

A typical SCA component is shown in Listing 1:

```
<composite xmlns="http://docs.oasis-open.org/ns/opencsa/sca/200912"
           targetNamespace=
              "http://docs.oasis-open.org/ns/opencsa/scatests/200903"
           name="TestComposite4">

    <component name="ComponentA">
       <implementation.java class="org.oasisopen.sca.Service1Impl"/>
        <service name="Service1">
          <interface.java interface="org.oasisopen.sca.Service1"/>
        </service>
        <property name="serviceName" value="AService"/>
        <reference name="reference1"/>
    </component>

</composite>
```

Listing 1: Example SCA component

The component "ComponentA" has an implementation, which in this example is a Java POJO implementation, declared using the <implementation.java/> element. The implementation.java element contains a reference to the implementation artifact, which in this example is a Java class with the name "Service1Impl" in the package "org.oasisopen.sca".

The remainder of the contents of the component declaration is configuration that is applied to the implementation at runtime. The component can declare all the services, references and properties of the implementation and apply configuration information to each of them. This can include things such as bindings for services and references and property values for properties.

Note that the configurable aspects of an SCA component implementation are called the componentType of the implementation - basically, it is the set of services, references and properties that the implementation has - for details of the componentType see the section "The ComponentType of an Implementation Artifact"

2.1 Describing the Implementation extension element

The implementation type documentation must describe the XML element that is used when declaring implementations of that type in an SCA component. It is highly recommended that the element is defined in a namespace that is owned by the same entity that owns the definition of the implementation type.

The name used for the implementation element needs to be unique - it must not use the same name as any other implementation type. The name can be derived from the programming language used for the implementation type (e.g. "python" or "ruby") or it can be derived from the technology used in the implementation (e.g. "spring"). By convention, the OASIS SCA technical committees have adopted a naming convention that forms an implementation extension element name by concatenating the string “implementation.” with the informal name of the implementation type. For example, <implementation.java/> represents the SCA POJO [SCA-POJO] implementation type.

Formally, the implementation extension element must be an element that is in the substitution group of the <sca:implementation/> element defined in the sca-core.xsd defined by the SCA Assembly specification [SCA-Assembly], as shown in Listing 2:

```
<!-- Implementation -->
<element name="implementation" type="sca:Implementation" abstract="true"/>
<complexType name="Implementation" abstract="true">
   <complexContent>
      <extension base="sca:CommonExtensionBase">
        <choice minOccurs="0" maxOccurs="unbounded">
           <element ref="sca:requires"/>
           <element ref="sca:policySetAttachment"/>
        </choice>
         <attribute name="requires" type="sca:listOfQNames"
                    use="optional"/>
         <attribute name="policySets" type="sca:listOfQNames"
                    use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

Listing 2: Declaration of base <implementation/> element and Implementation type.

The implementation extension element must be declared as an element in the substitution group of the sca:implementation element and must be declared to be of a type which is an extension of the sca:Implementation type.

The <implementation.java/> element declaration can serve as a useful model, as shown in Listing 3:

```
<!-- Java Implementation -->
<element name="implementation.java" type="sca:JavaImplementation"
```

```
          substitutionGroup="sca:implementation"/>
<complexType name="JavaImplementation">
   <complexContent>
      <extension base="sca:Implementation">
         <sequence>
            <any namespace="##other" processContents="lax"
                 minOccurs="0" maxOccurs="unbounded"/>
         </sequence>
         <attribute name="class" type="NCName" use="required"/>
      </extension>
   </complexContent>
</complexType>
```

Listing 3: Declaration of <implementation.java/> element

The implementation extension element element should allow for attributes and/or subelements which describe the implementation artifact to be used as the SCA component implementation, such as the @class attribute of <implementation.java/>. If necessary, one or more attributes and subelements can be used to describe the implementation artifact (other than the configuration of services, references and properties supplied by the component).

Regarding the location of the implementation artifact, the location should always be taken as relative to the SCA contribution which contains the composite holding the component declaration.

2.2 The ComponentType of an Implementation Artifact

For a implementation of any type, its features that relate to SCA component conceptsare declared in the implementation artifact's componentType [SCA-Assembly].

The implementation type documentation must define how the componentType is defined for any given implementation artifact that is used with the implementation type. There are two general approaches to this:

1. calculate the componentType by introspecting the implementation artifact itself
2. provide a separate componentType file which contains a full declaration of the componentType for the given implementation artifact

An example of the introspection approach is shown in the componentType section of the Java POJO implementation type specification [SCA-POJO]. An example of the approach using a separate componentType file is shown in the SCA Client and Implementation Model for the C++ [SCA-CPP].

In either case, the implementation type documentation must describe how the componentType is related to the content of the implementation artifact itself, both in terms of the base content of the artifact and also the impact of any SCA-specific language extensions and customizations that are available for use with an implementation of this type.

The <sca:componentType/> element is declaration is shown in Listing 4:

```
<!-- Component Type -->
<element name="componentType" type="sca:ComponentType"/>
<complexType name="ComponentType">
   <complexContent>
      <extension base="sca:CommonExtensionBase">
         <sequence>
            <element ref="sca:implementation" minOccurs="0"/>
            <choice minOccurs="0" maxOccurs="unbounded">
               <element name="service" type="sca:ComponentService"/>
               <element name="reference"
                  type="sca:ComponentTypeReference"/>
               <element name="property" type="sca:Property"/>
            </choice>
```

```
            <any namespace="##other" processContents="lax" minOccurs="0"
                 maxOccurs="unbounded"/>
          </sequence>
        </extension>
      </complexContent>
    </complexType>
```

Listing 4: ComponentType declaration.

In essence, the componentType of an implementation declares the services, the references and the properties of the implementation artifact, which are customised by a component that uses the implementation.

Support for Bidirectional Interfaces and for Long Running Request/Response operations

An important feature of the SCA model is its capability of defining service interactions between components that are asynchronous in nature - where the timing and/or the type of a response to a request can vary. There are two main aspects of SCA which support this

- Bidirectional interfaces
- Long-Running Request/Response operations

The implementation type documentation must describe how both of these aspects of SCA are handled both for a component which is a service client and also for a component which is a service provider.

2.3 SCA Extensions and Customizations for Implementation Artifacts

An implementation type can either simply use the existing features of a particular implementation language (e.g. the Java language, the C++ language), or it may provide some SCA-specific extensions or customizations that can be useful to the programmer when creating implementation artifacts that are designed for use with SCA. These extensions and customizations may affect the componentType of an implementation artifact and/or affect the runtime behaviour of the artifact. Examples of extensions and customizations include SCA-specific annotations and SCA-related APIs.

If SCA-specific extensions or customizations are available for an implementation type, the implementation type documentation must describe all of the available extensions and customizations. The implementation type documentation must describe the impact of the extensions and customizations on the componentType of the implementation artifact and it must also describe the impact of the extensions and customizations on the runtime behaviour of the implementation artifact, if any.

An example of an extension can be seen in the Java POJO specification [SCA-POJO] with the @Reference annotation, which allows a programmer to mark a field, a constructor parameter or a setter method as an SCA reference.

2.4 Describing the Runtime Behaviour of an Implementation Artifact

The implementation type documentation must describe the runtime behaviour of instances of SCA components which use implementation artifacts described by the implementation type.

In particular, the documentation must describe how the SCA component configuration affects the configuration of a component instance at runtime - how services are invoked, how references are obtained and how they are invoked, how property values are mapped to types in the implementation's runtime and obtained by the component implementation.

The lifecycle of runtime instances must be described - when implementation instances are created, how long they live and when they are destroyed, in relation to the containing SCA component and in relation to

service invocations related to the component. The number of instances belonging to a single component must be described along with any serialization and multi-threading considerations.

If there are runtime exceptions or faults that apply to implementation type artifacts, these must be described by the implementation type documentation.

2.5 Describing an Interface Type associated with an Implementation Type

An implementation type may have an associated interface type which it uses when describing the interfaces of services and references. If the implementation type is able to use an existing interface type, e.g., interface.wsdl or interface.java, then the implementation type documentation can simply reference the documentation for that interface type.

However, if the implementation type uses an interface type that is not described in the documentation for some existing implementation type, then the implementation type documentation must describe the interface type.

For some new interface type, there are essentially two pieces of information to provide:

- a definition of the interface extension element
- a definition of the mapping of the interface type to interface.wsdl. All remotable interfaces must be mappable to interface.wsdl

It is highly recommended that the interface extension element is defined in a namespace that is owned by the same entity that owns the definition of the interface type.

The name used for the interface extension element needs to be unique - it must not use the same name as any other interface type. The name can be derived from the programming language used for the interface type (e.g. "java") or it can be derived by any other means that makes sense in the context of the interface type.

Describing the interface extension element is similar in nature to describing an implementation extension element. The interface extension element must be declared as an element in the substitution group of the <sca:interface/> element and must be declared to be of a type which is an extension of the sca:Interface type. The base <sca:interface/> element and sca:Interface type are defined in sca-core.xsd by the SCA Assembly specification [SCA-Assembly] and are shown in Listing 5:

```
<!-- Interface -->
<element name="interface" type="sca:Interface" abstract="true"/>
<complexType name="Interface" abstract="true">
   <complexContent>
      <extension base="sca:CommonExtensionBase">
         <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="sca:requires"/>
            <element ref="sca:policySetAttachment"/>
         </choice>
         <attribute name="remotable" type="boolean" use="optional"/>
        <attribute name="requires" type="sca:listOfQNames"
            use="optional"/>
        <attribute name="policySets" type="sca:listOfQNames"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

Listing 5: Declaration of base interface element and Interface type.

By convention, the OASIS SCA technical committees have adopted a naming convention that forms an interface extension element name by concatenating the string “interface.” with the informal name of the

interface type. For example, the <interface.java/> element declaration from the SCA Common Annotations and APIs specification [SCA-JAVACAA] can serve as a useful model, as shown in Listing 6:

```
<!-- Java Interface -->
<element name="interface.java" type="sca:JavaInterface"
         substitutionGroup="sca:interface"/>
<complexType name="JavaInterface">
   <complexContent>
      <extension base="sca:Interface">
         <sequence>
            <any namespace="##other" processContents="lax" minOccurs="0"
                 maxOccurs="unbounded"/>
         </sequence>
         <attribute name="interface" type="NCName" use="required"/>
         <attribute name="callbackInterface" type="NCName"
                    use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

Listing 6: Declaration of the interface.java element.

Note that the <interface.java/> element is in the substitution group of <sca:interface/> and its type is an extension of the sca:Interface type.

The interface extension element should allow for attributes and/or subelements which describe the interface artifact, such as the @interface and @callbackInterface attributes of <interface.java/>. If necessary, one or more attributes and subelements can be used to configure the interface artifact.

Regarding the location of the interface artifact, the location should always be taken as relative to the SCA contribution which contains the composite holding the component declaration.

Support of Local and Remotable Interfaces

The SCA Assembly specification [SCA-Assembly] defines the concepts of ***local*** and ***remotable*** interfaces. Where a new interface type is defined, the implementation type documentation must define how these concepts apply to the interface type.

Interface Compatibility rules

The compatibility of two interface declarations is an important part of the SCA model. This is discussed in detail in the SCA Assembly specification [SCA-Assembly]. Where a new interface type is defined, the implementation type documentation must define the compatibility rules for the interface type, including superset interfaces, subset interfaces and equal interfaces.

2.6 Describing the behaviour of Implementation artifacts within Contributions

Artifacts of all types are made available for use in an SCA application by means of ***contributions*** which are deployed into the SCA Domain used by the SCA runtime, Contributions are defined in the SCA Assembly specification [SCA-Assembly]. Essentially, a contribution is a collection of artifacts that are organized into a hierarchy based off a single root.

Whenever a reference is made to an artifact of a particular implementation type, for example a reference within an implementation type element, that artifact must be found within the contributions deployed into the domain.

The default location for an artifact is within the SCA contribution where the reference is made - i.e. where the implementation type element appears in a composite file within a particular contribution, that same

contribution is searched. It is expected that the implementation type element contains configuration that identifies the artifact. This identification can take the form of a filename or package name, which can include the hierarchy path for the artifact (eg directory path or Java package name). Alternatively, the identification may involve a namspace, where the assumption is that all artifacts of a given type are searched to find a matching namespace and element name, as occurs for XML artifacts (e.g. BPEL processes).

The implementation type documentation must describe the way in which the artifact reference information is used to locate a specific artifact. The documentation must also describe the permitted organization of the artifacts within a contribution.

Some implementation types can also allow for implementation artifacts to be imported into one contribution from a second (exporting) contribution, as described in the "SCA Artifact Resolution" section of the SCA Assembly specification [SCA-Assembly]. Where this is supported, the implementation type documentation must describe how the import works. Import and Export of artifacts can either follow the base mechanism described in the SCA Assembly specification, which is based on the use of namespaces, or it may follow an implementation-type specific mechanism.

The base mechanism involves the declaration of <sca:export/> and <sca:import/> elements with an sca-contribution.xml file that is in the META-INF directory of the contribution.

Implementation-Type specific forms of Import and Export

Where an implementation type requires the use of a specific form of import and export mechanism for the resolution of artifacts between contributions, the implementation type documentation is required to define how this works.

An example of such a mechanism exists for the Java POJO implementation type [SCA-POJO].There are base importBase and exportBase elements and types defined in the SCA Assembly specification [SCA-Assembly]. For the Java POJO implementation, <import.java/> and <export.java/> elements are defined as shown in Listing 7:

```
   <!-- Import.java -->
<element name="import.java" type="sca:JavaImportType"
substitutionGroup="sca:importBase" />
   <complexType name="JavaImportType">
      <complexContent>
         <extension base="sca:Import">
            <attribute name="package" type="string" use="required"/>
            <attribute name="location" type="anyURI" use="optional"/>
         </extension>
      </complexContent>
   </complexType>

   <!-- Export.java -->
   <element name="export.java" type="sca:JavaExportType"
    substitutionGroup="sca:exportBase" />
   <complexType name="JavaExportType">
      <complexContent>
         <extension base="sca:Export">
            <attribute name="package" type="string" use="required"/>
         </extension>
      </complexContent>
   </complexType>
```

Listing 7: Definition of the <import.java/> and <export.java/> elements

An implementation type must define import and export elements that extend the base Import and Export types. By convention, the OASIS SCA technical committees have adopted a naming convention that forms import and export extension element names by concatenating the strings “import.” and "export." with the informal name of the implementation type.

Implementation-Type specific forms of Contribution

One format of contribution packaging is mandatory - the ZIP file contribution format. However, SCA allows for many other contribution formats. If an implementation type has a specialized contribution format, then the implementation type documentation must provide a definition of that format.

Conformance

The last numbered section in the specification must be the Conformance section. Conformance Statements/Clauses go here.

Appendix A. Acknowledgments

The following individuals have participated in the creation of this specification and are gratefully acknowledged

Participants:

- Mike Edwards, IBM

Appendix B. Non-Normative Text

Appendix C. Revision History

Revision	Date	Editor	Changes Made
1	19/04/10	Mike Edwards	Initial version created
2	23/04/10	Dave Booz Mike Edwards	Extensive revisions and updates. Completion of the section on contributions Additional sections on Interfaces and Implementations