10.1.3 Exhibit

Exhibit element represents a physical thing presented as evidence because it is believed to confer evidential support to some claims. Exhibit element in the Evidence Metamodel is a representative of this physical thing within the Evidence Model, so that statements involving this element can be constructed, for example statements that assert fundamental characteristics of this element or its various relationships with other elements of the Evidence Model. The nature of Exhibit as something that is presented as evidence and subsequently stored in an appropriate evidence repository, provides the scope of what can be presented as evidence. For example, a "knife" can be presented as evidence, but a person cannot be. A person can have viewed as a witness or an expert, and his opinion recorded as a document, which then can be presented as evidence. The SACM Evidence Metamodel emphasizes computer-based evidence repositories, which can only store electronic representations of physical things. So the "electronic source" of a "knife" thing will likely be a photograph of the knife.

A most common kind of an exhibit is a Document. Document is a special thing, because it is a direct expression of some meaning in certain media. Document involves the use of a language to express its meaning. In comparison any other physical thing may represent a meaning only in a very indirect way. Physical things require non-trivial (and highly contestable) interpretation, as to what meaning they may represent. The importance of documents as elements of evidence cannot be underestimated, since evidentiary support is a form of establishing defensible relation between some physical things and claims, which are elements of meaning. This transition from physical things to meanings needs to be performed as early as possible in the process of building an assurance case. The Evidence Metamodel provides the means to document this transition and confine it to the scope of the evidence package, so that the rest of an assurance case can operate only with claims as elements of meaning, rather than with any physical things, including documents.

The Evidence Metamodel defines some common properties of exhibits including the name (short title) of the exhibit, electronic source of the exhibit, the media (the material of the thing).

Superclass	Example
Caperciass	The first example illustrates basic tags for Exhibit element.
EvidenceItem	<item id="exh01" name="Report cover</th></tr><tr><th></th><td>page snapshot" xsi:type="EM:Exhibit"></item>
Attributes	
Chaine	The second example illustrates an Exhibit with an annotation
• name:String	and several associated statements (timing, provenance and
The short title of the exhibit.	derivation)
• url:String	<item id="exh02" name="OV2 diagram" xsi:type="EM:Exhibit"></item>
The URL to the original exhibit, if it is a web resource.	<annotation content="Snapshot of the OV2 diagram"></annotation>
	<pre><timing datetime="30-07-2014</pre></th></tr><tr><th>Associations</th><th>10:20" xsi:type="EM:AtTime"></timing></pre>
• property: Exhibit Property[0 *]	<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>
• property.Exhibit roperty[0]	<pre><pre>content </pre><pre><pre>content </pre><pre>content </pre><pr< td=""></pr<></pre></pre>
The set of essential properties of the exhibit.	
Semantics	

Exhibit element represents a physical thing that is presented as evidence in support of some claims. Additional facts related to the Exhibit are asserted as ExhibitProperty statements in which the current Exhibit is the subject. These statements are represented as owned ExhibitProperty elements.

10.1.4 Document

Document element represents a "document" that is defined as follows:

- 1. an original or official paper relied on as the basis, proof, or support of something;
- 2. something (as a photograph or a recording) that serves as evidence or proof;
- 3. a) a writing conveying information; b) a material substance (as a coin or stone) having on it a representation of thoughts by means of some conventional mark or symbol [Merriam-Webster Dictionary].

Document element is the main subclass of Exhibit. Document is a special thing, because it is a direct expression of some meaning in certain media. In Software Assurance, most documents are electronic, however some documents may exist on paper or any other media. Document involves the use of a language to express its meaning. In comparison any other physical thing may represent a meaning only in a very indirect way. Physical things require non-trivial (and highly

contestable) interpretation, as to what meaning they may repr are representations of some meaning rather than of an expres refer to some physical things as its extent but it may not con perspective, a Document is a vital kind of a physical object, v a limited interpretation. The importance of documents as ele evidentiary support is a form of establishing defensible relati elements of meaning. This transition from physical things to process of building an assurance case. The Evidence Metamo confine it to the scope of the evidence package, so that the r

The SACM Evidence Metamodel defines some common pro Several properties are defined as attributes of the class Docu association classes, which are concrete subclasses of Docum several attributes of a Document that characterize its quality

Superclass

Exhibit

Attributes

- title:String The full title of the document
- citation:String

The full citation of the document (bibliographical reference)

Semantics

Document element represents a physical thing that directly expresses a certain meaning. The meaning is the content of the document. Because of the ambiguity of natural languages, some documents may express more than one meaning. Formal documents usually have a single meaning. Additional facts related to the Document are asserted as DocumentProperty statements in which the current Document is the subject. These statements are represented as owned DocumentProperty elements.

10.1.5 Record

Record element represents Exhibits that are explicit records of compliance, for example log entries. Record is different from a Document, since a Document element represents some physical thing that exists elsewhere in the physical world (even if it is an electronic document), while a Record element exists only in the EvidenceContainer.

Example <item xsi:type="EM:Document" id="doc02" name="SAR Model" title="Search and Rescue Enterprise DoDAF Model"> <annotation content="SAR model"/> provenance xsi:type="EM:CreatedBy" source="org01"/ > provenance xsi:type="EM:ApprovedBy" supervisor="org02"/> <property xsi:type="EM:Originality" value="original"/> property xsi:type="EM:Reliability" value="completelyReliable"/> property xsi:type="EM:Consistency" value="formal"/> <property xsi:type="EM:Completeness" status="final"/> </item> <item xsi:type="EM:Document" id="doc03" name="SAR OV" title="Search and Rescue Operational Viewpoint"> <property xsi:type="EM:IsPartOf" whole="doc03"/> </item>



Record is defined as "a thing constituting a piece of evidence about the past, esp. an account of an act or occurrence kept in writing or some other permanent form." In the Evidence Metamodel Record element is such a thing. In contrast to a Document element, a Record is not a representative of some other physical thing, but the thing itself. A Record is therefore similar to an Object; however, it is considered a structured element with an informal content rather than a formal element.

10.1.6 FormalElement (abstract)

FormalElement is an abstract class that represents any elements of meaning that are associated with things presented as evidence or otherwise involved in the evidence collection.

Superclass

EvidenceItem

Semantics

FormalElement is an element of meaning that represents a certain individual concept, a noun concept, verb phrases, and propositions. Two subclasses of FormalElement are FormalObject, representing noun concepts, and FormalAssertion, representing verb concepts and propositions.

10.1.7 FormalObject (abstract)

FormalObject is an abstract class that represents any elements of meaning that are noun concepts associated with the things that are collected as evidence or are otherwise involved in the evidence collection. FormalObject may represent a concept corresponding to an individual concrete physical thing, such as "an axe with stains of blood on it," or a collection of things, referred to as a whole, or a concept, such as a "murder weapon." Physical things need to be represented as the exhibits. On the other hand, concepts are usually not collected as evidence, rather they are used as the elements of meaning in order to build assertions, as well as other relations describing the items of evidence. For example, in order to describe the above mentioned "axe" as a "murder weapon," the instance of a FormalObject with the name "murder weapon" is used. This object represents a concept that is involved in making a claim that also involves a concrete physical thing. FormalObjects represent concepts in the subject area for which the argument is being developed. Many elements of the Evidence Metamodel are concepts related to evidence. In particular, Exhibit and Document are two key concepts related to evidence.

Superclass

FormalElement

Constraints

ExtendedDocumentProperty element shall own at least one TaggedValue describing the meaning of the element.

Semantics

ExtendedDocumentProperty is a user-defined characteristic. Its meaning is represented by the key-value pair of the corresponding TaggedValue element.

ExtendedDocumentProperty characteristic cannot be verbalized using the standard vocabulary of the Structured Assurance Case Metamodel. However, the key and value pair may be carefully named to result in meaningful verbalizations for the targeted community in the selected language.



>property xsi.type= EM.ExtendedDocumentProperty >

<taggedValue key="compliesTo" value="DoDAF 2.0"/>

provenance xsi:type="EM:ApprovedBy" supervisor="org03"/>

</property>

</item>

Associations

• role:RoleBinding[0..*]

Set of role bindings that further describe which FormalObjects are bound to the roles that are determined by the fact type.

• definition:MOF::Element

A link to an entry of an external SBVR vocabulary or an OWL ontology defining the fact type of the assertion.

Semantics

Assertion is an element of meaning that states existence of a relationship between several individual formal objects. In a formal assurance case, the nature of the relationship is specified through a reference to an external vocabulary, such as an SBVR vocabulary or an OWL ontology. SACM assumes that community of interest for an assurance case will acquire or develop such vocabularies for the corresponding subject area. In a semi-formal assurance case the nature of the relationship can be described informally through a 'content' property. In this case the 'definition' property and the 'facttype' property shall not be used. However the references to the exact FormalObjects through RoleBinding elements still can be stated. The 'content' property of the FormalAssertion element provides the verbalization of the assertion, which is the expression of the assertion in the selected natural language. For informal assurance cases, a ReferencedClaim element can be used, which only contains the verbalization of the claim in a natural language.

12.3.2 ReferencedClaim

ReferencedClaim is an element of meaning that represents an informal assertion about the state of affairs in the subject area about which an assurance case is developed. ReferencedClaim can be linked to a Claim element of the Argumentation part of an assurance case.

Superclass

FormalAssertion

Associations

claim:Argumentation::Claim[0..1]
 A link to a Claim element in the Argumentation part of an assurance case (if available).

Semantics

ReferencedClaim is an element of meaning that makes an assertion about a subject area of an assurance case. ReferencedClaim represents the claim as prose in a selected natural language (formal or informal), without identifying its structure. ReferencedClaim element can represent informal claims (claims not linked to any formal definition of its meaning, such as an ontology developed by some community of meaning) or unstructured claims (where the subjects are not identified).

Usually claims assert existence of a formally defined relationship between several individual subjects and involve several objects bound to specific roles. An Assertion element can be used to capture this structure of a claim in a more formal way. In particular, Assertion element can link the proposition to an external vocabulary or ontology that defines the exact meaning of the proposition, as well as the exact subjects of the proposition.

12.3.3 RoleBinding

A claim usually states existence of a relationship between several individual domain objects and involves several subjects bound to specific roles. RoleBinding element is used to capture this structure of a claim in a more formal way in the context of an Assurance element representing the claim.

А

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

<SACM:AssuranceCase xmi:version="2.0" xmlns:xmi="http://www.omg.org/XMI" xmlns:xsi="http://www.w3.org/ 2001/XMLSchema-instance" xmlns:ARM="http://schema.omg.org/SACM/1.0/Argumentation" xmlns:EM="http:// schema.omg.org/SACM/1.0/Evidence" xmlns:SACM="http://schema.omg.org/SACM/1.0" name="DoDAF Analytics" <u>gid=</u>"org.omg.sacm.examples-ac01-30072014">

<argument>

<argumentElement xsi:type="ARM:Claim" id="claim01" content="Risk of Search and Rescue Enterprise is High"/
>

<argumentElement xsi:type="ARM:AssertedEvidence" source="docum01" target="claim01"/>

<argumentElement xsi:type="ARM:InformationElement" id="docum01" description="SAR Risk Assessment report" evidence="doc07"/>

</argument>

<evidence name="SAR DoDAF Analytics" id="ec03" gid="org.omg.sacm.examples-ec02-30072014">
 <item xsi:type="EM:ReferencedClaim" id="rc01" content="SAR Model is likely acceptable as input to automated
risk assessment"/>

<evaluation xsi:type="EM:Supports" assertion="rc05" subject="rc01"> <attribute xsi:type="EM:Support" value="indirect"/> <attribute xsi:type="EM:Strength" value="40"/> </evaluation>

<item xsi:type="EM:ReferencedClaim" id="rc01" content="SAR Model is likely acceptable as input to automated risk assessment"/>

</evidence>

</SACM:AssuranceCase>

EffectiveTime statement asserts a time interval associated with the subject, during which the subject is asserted to be "effective." For example, in case of an EvidenceAssertion or a FormalAssertion, this statement asserts a time interval at which the corresponding statement is asserted to be true. In case of an EvidenceItem this statement asserts the relevant time context in which the element shall be considered.

13.5.3 StartTime

StartTime statement identifies the start of the effective time interval of the owner evidence object.

Superclass

EffectiveTime

Attributes

_____ datetime:EDate[1] into datetime:Datetime

datetime:EDate[1]

Date starting from which the owner object becomes valid.

Constraints

- One object shall not own more than one StartTime property.
- When object owns StartTime and EndTime, the datetime of the StartTime property shall be earlier than or equal to the datetime of the EndTime property.

Semantics

StartTime statement asserts the state of affairs that the owner object is valid starting from the datetime stated by the StartTime property.

13.5.4 EndTime

EndTime statement identifies the end of the effective time interval of the owner evidence object.

Superclass

EffectiveTime

Attributes

datetime:EDate[1] into datetime:Datetime

datetime:EDate[1]
 Date after which the owner object ceases to be valid.

Constraints

- One object shall not own more than one EndTime property.
- When object owns StartTime and EndTime, the datetime of the EndTime property shall be later than or equal to the datetime of the StartTime property.

EndTime statement asserts the state of affairs that the owner object is not valid after from the datetime stated by the EndTime property.

13.5.5 AtTime

AtTime statement identifies the time stamp for the owner evidence object. The context for the timestamp is given by the owner object.

Superclass

TimingProperty

Attributes

•

datetime:EDate[1] into datetime:Datetime

datetime:EDate[1] The timestamp associated with the owner object.

Semantics

AtTime statement asserts the state of affairs that involves an association between the owner object and the datetime stated by the AtTime property.

Superclass

EvidenceEvaluation

Associations

• subject:EvidenceItem[1]

The EvidenceItem instance, such as an Exhibit or a Document that is the subject of an evidentiary support to a FormalAssertion object such as a ReferencedClaim.

• assertion:FormalAssertion[1] FormalAssertion instance that receives an evidentiary support from the EvidenceItem object.

Constraints

• FormalAssertion shall not receive evidence relation from self.

Semantics

EvidenceRelation is a unit of information generated during evidence evaluation. It represents a relationship between an EvidenceItem and FormalAssertion objects that is asserted during the evidence evaluation.

14.2.2 Supports

Supports statement represents an evidence relation between one EvidenceItem and one FormalAssertion element where the EvidenceItem confers evidentiary support to the FormalAssertion.

Superclass

EvidenceRelation

Semantics

Supports statement is asserted during evidence evaluation. It represents a relationship between an EvidenceItem and FormalAssertion objects where the EvidenceItem confers evidentiary support on the claim represented by FormalAssertion. This relationship is verbalized as: "EvidenceItem supports FormalAssertion."

14.2.3 Challenges

Challenges statement represents an evidence relation between one EvidenceItem and one FormalAssertion element where the EvidenceItem challenges the validity of the FormalAssertion.

Superclass

EvidenceRelation

Semantics

Challenges statement is asserted during evidence evaluation. It represents a relationship between an EvidenceItem and FormalAssertion objects where the EvidenceItem is the so-called counter evidence to the claim represented by the FormalAssertion object, i.e., the EvidenceItem challenges the validity of the domain claim represented by the FormalAssertion. This relationship is verbalized as: "EvidenceItem *challenges* FormalAssertion."

Example <evaluation xsi:type="EM:Challenges" id="eval05" assertion="rc02" subject="rec28"/>

В



This example illustrates Support statements. The first statement asserts that record "rec01" supports referenced claim "rc02". This statement does not involve any additional clauses. The second example illustrates how one referenced claim provides fairly strong direct support to another referenced claim. The third example illustrates how one referenced claim provides very strong but mildly relevant direct support to another referenced claim.

<evaluation xsi:type="EM:Supports" id="eval01" assertion="rc02" subject="rc01"/>

<evaluation xsi:type="EM:Supports" id="eval02" assertion="rc01" subject="rc02"> <attribute xsi:type="EM:Support" value="direct"/> <attribute xsi:type="EM:Strength" value="60"/> </evaluation> <evaluation xsi:type="EM:Supports" id="eval03" assertion="rc01" subject="rc03">

<evaluation xsi:type="EM:Supports" id="eval03" assertion="rc01" subject="rc03">
<attribute xsi:type="EM:Support" value="direct"/>

<attribute xsi:type="EM:Strength" value="100"/>

<attribute xsi:type="EM:Relevance" value="mediumHigh"/>

```
</evaluation>
```

<item xsi:type="EM:Record" id="rec01" name="Score of OV viewpoint" content="Score of OV viewpoint is Medium">

<event xsi:type="EM:IsGeneratedAt">

```
<timing xsi:type="EM:AtTime" datetime="30-07-2014 10:20"/>
```

<custody xsi:type="EM:UsingProcess" method="tool01"/>

```
</event>
```

```
</item>
```

<item xsi:type="EM:ReferencedClaim" id="rc01" content="SAR Model is likely acceptable as input to automated risk assessment"/> <item xsi:type="EM:ReferencedClaim" id="rc02" content="Score of SAR OV is Medium"/>

<item xsi:type="EM:ReferencedClaim" id="rc03" content="Score of SAR CV scores is High"/>

Example <evaluation xsi:type="EM:Conflicts" id="eval06" assertion="rc03" subject="rc02"> <attribute xsi:type="EM:Strength" value="30"/> <attribute xsi:type="EM:Significance" value="mediumLow"/> </evaluation>

Semantics

The Conflicts statement asserts a state of affairs that the FormalAssertion-1, identified as the assertion 1 of the Conflicts element, is in conflict with FormalAssertion that is identified as the assertion2 of the Conflicts element. Conflict here is defined as a state of doubt that both assertions can be true at the same time. The conflict needs to be resolved by clarifying the meaning of the assertions, negating or refuting the supporting evidence to one of the assertions, etc.

This statement is verbalized as follows: "FormalAssertion-1 conflicts FormalAssertion-2"

14.5.3 Contributes (abstract)

Contributes statement asserts dependency between two EvidenceRelation elements. For example, let's assume the following evidentiary relationships:

Exhibit A supports (referenced) claim that "Bob is married to Alice"

Exhibit A challenges claim "Bob is single"

We can observe that the claim "Bob is married to Alice" conflicts with the claim "Bob is single"

Let's further assume the following evidentiary relationship:

Exhibit C supports claim Exhibit A is likely a forgery

We can observe that:

The evidence assertion $\underline{\text{Exhibit } \underline{\text{C}}}$ supports $\underline{\text{claim}}$ "Exhibit A is likely a forgery" weakens $\underline{\text{support given by the Exhibit}}$ <u>A to the claim</u> "Bob is married to Alice"

At the same time we do not directly assert that:

Exhibit C challenges the claim "Bob is married to Alice"

Evidence observations help capture dependencies between related claims and thus facilitate evaluation of evidence.

Superclass

EvidenceObservation

Associations

- subject: EvidenceRelation[1]
 The subject EvidenceRelation
- relation: EvidenceRelation[1] The object EvidenceRelation

Constraints

The subject and object EvidenceRelation elements shall not be the same.

Semantics

The Contributes statement asserts existence of a dependency in evidentiary support. The concrete subclasses of the Contributes element define the exact nature of the dependency.

14.5.4 Weakens

Weakens statement asserts that the subject EvidenceRelation weakens another EvidenceRelation2. This statement has a different meaning than a statement about existence of an evidence item that (directly) challenges the FormalAssertion involved in the EvidenceRelation2. Weakens relation may imply a conflict between the subject FormalAssertion that is involved in the subject EvidenceRelation and FormalAssertion2. In that case the evidence in support of the subject FormalAssertion2.

Superclass

Contributes

Example
 <evaluation xsi:type="EM:Weakens" subject="eval05" relation="eval01">
 <attribute xsi:type="EM:Relevance" value="mediumLow"/>
 </evaluation>

Semantics

The Weakens statement asserts a state of affairs that the EvidenceRelation-1, identified as the 'subject' of the Weakens element, weakens EvidenceRelation-2 that is identified as the 'relation' of the Weakness element. The Weakens statement asserts a negative contribution made by one EvidenceEvaluation to another EvidenceEvaluation. Weakens may imply a conflict between the 'subject' FormalAssertion-1 that is identified as assertion of EvidenceRelation-1 and FormalAssertion-2 that is identified as assertion of EvidenceRelation-2.

This statement is verbalized as follows: "Evidentiary support to FormalAssertion-1 weakens evidentiary support to FormalAssertion-2", where the statement "Evidentiary support to a FormalAssertion C1" is an objectified assertion that there is an evidence item E1 that supports the FormalAssertion C1".

14.5.5 Amplifies

Amplifies statement asserts that the subject EvidenceRelation amplifies another EvidenceRelation2. This statement has a different meaning than the statement asserting existence of an evidence item that (directly) supports the FormalAssertion2 that is involved in the EvidenceRelation2. Amplifies relation may imply a coupling between the subject FormalAssertion and the FormalAssertion2. In that case the evidence in support of the subject FormalAssertion may be relevant to the FormalAssertion.



Semantics

The Amplifies statement asserts a state of affairs that the EvidenceRelation-1, identified as the subject, amplifies EvidenceRelation-2 that is identified as the relation of the Amplifies element. The Amplifies statement asserts a positive contribution made by one EvidenceEvaluation to another EvidenceEvaluation. Amplifies may imply a coupling between FormalAssertion-1 that is identified as assertion of EvidenceRelation-1 and FormalAssertion-2 that is identified as assertion of EvidenceRelation-2.

This statement is verbalized as follows: "Evidentiary support to the subject FormalAssertion amplifies evidentiary support to FormalAssertion2."

14.6 Evidence Resolutions Class Diagram

The EvidenceResolutions Class Diagram defines several EvidenceEvaluation elements that allow assertions regarding the resolutions to EvidenceEvaluation elements for the purpose of explaining the conflicts between FormalAssertions. The Evidence Metamodel provides three options: Negate EvidenceRelation, Refute a FormalAssertion, and Resolve

 property:ProjectProperty[0..*] List of project property clauses.

Constraints

- EvidenceContainer shall not be the object of the requiresContainer relation owned by the EvidenceContainer, either directly or indirectly through requiresContainer of other EvidenceContainers.
- Any EvidenceContainer that is the object of the requiresContainer relation shall be available for exchange.
- [Completeness of the evidence container with respect to required evidence containers]
 Any Element that is referenced by any of the Elements defined in the package (i.e., that are members of the lists item, evaluation, or element of the EvidenceContainer) shall be defined also in the EvidenceContainer or in one of the EvidenceContainers that are referred to as objects of the requiresContainer relation either directly or indirectly. An Element is referenced if it is an object of an EvidenceProperty or an EvidenceEvaluation.
- EvidenceProperty, EvidenceEvaluation, EvidenceRequest, EvidenceAction, ProjectObjective elements shall not be referenced across evidence containers.

Semantics

EvidencePackage element is the root object of an instance of the Evidence Metamodel (which can be referred to as Evidence Model). A single EvidenceContainer is a unit of exchange of evidence information. All Elements defined in an EvidenceContainer are exchanged together as part of the EvidenceContainer. Elements that are referenced shall be either present in the EvidenceContainer or in one of the EvidenceContainers that is specified as required for the EvidenceContainer. The Evidence Metamodel does not require completeness of the closure of all required packages.

The statements associated with the EvidenceContainer element make assertions regarding the current container (use the current container as the subject of the corresponding clauses). Therefore, the following elements owned by an EvidenceContainer can be readily interpreted in the above way:

- RequiresContainer (for example, verbalized as "the EvidenceContainer requires EvidenceContainer X1").
- ContainerConsistency (for example, verbalized as "elements of the EvidenceContainer are interpreted formally").
- ContainerCompleteness (for example, verbalized as "the EvidenceContainer is in draft state").
- Complies To (for example, verbalized as "the EvidenceContainer complies to Resolved Counter Evidence proof standard").

All ProjectProperties clauses directly owned by an EvidenceContainer shall be interpreted with the EvidenceContainer as the main subject. For example, "the EvidenceContainer depends on evidentiary support rendered by Exhibit E1 to Claim Testing is completed."

15.3 ProjectElements Class Diagram

ProjectElements Class Diagram defines several auxiliary elements that are used in various statements as predicate clauses for some main clause is some evidence element. The elements defined at this class diagram are collectively referred to as the project elements. They are required to express various evidence statements related to evidence collection, evaluation, and evidence management.

C)

Example <<u>?xml</u> version="1.0" encoding="UTF-8"?>

<SACM:AssuranceCase xmi:version="2.0" xmlns:xmi="http://www.omg.org/XMI" xmlns:xsi="http://www.w3.org/2001/XMLSchemainstance" xmlns:ARM="http://schema.omg.org/SACM/1.0/Argumentation" xmlns:EM="http://schema.omg.org/SACM/1.0/Evidence" xmlns:SACM="http://schema.omg.org/SACM/1.0" name="DoDAF Analytics" gid="org.omg.sacm.examples-ac01-30072014">

<argument></argument>

```
<evidence name="SAR DoDAF Analytics" id="ec02" gid="org.omg.sacm.examples-ec02-30072014">
  <evaluation xsi:type="EM:Supports" id="eval01" assertion="rc02" subject="rec01"/>
<evaluation xsi:type="EM:Supports" id="eval02" assertion="rc03" subject="rec02"/>
   <evaluation xsi:type="EM:Supports" id="eval03" assertion="rc04" subject="rec03"/>
<item xsi:type="EM:Document" id="doc05" name="SAR DoDAF Analytics Report" title="Search and Rescue DoDAF Assessment">
    <custody xsi:type="EM:UsingProcess" method="met01"/>
<custody xsi:type="EM:UsingProcess" method="tool01"/>
<provenance xsi:type="EM:CreatedBy" source="per03"/>
    <property xsi:type="EM:IsBasedOn" source="doc01"/>
   </item>
   <item xsi:type="EM:Record" id="rec01" name="Score of OV viewpoint" content="Score of OV viewpoint is Medium">
    <event xsi:type="EM:IsGeneratedAt">
      <timing xsi:type="EM:AtTime" datetime="30-07-2014 10:20"/>
      <custody xsi:type="EM:UsingProcess" method="tool01"/>
    </event>
   </item>
   <item xsi:type="EM:Record" id="rec02" name="Score of CV viewpoint" content="Score of CV viewpoint is High">
    <event xsi:type="EM:IsGeneratedAt">
      <timing xsi:type="EM:AtTime" datetime="30-07-2014 10:20"/>
      <custody xsi:type="EM:UsingProcess" method="tool01"/>
    </event>
   </item>
   <item xsi:type="EM:Record" id="rec03" name="Score of DIV viewpoint" content="Score of DIV viewpoint is High">
    <event xsi:type="EM:IsGeneratedAt">
      <timing xsi:type="EM:AtTime" datetime="30-07-2014 10:20"/>
      <custody xsi:type="EM:UsingProcess" method="tool01"/>
    </event>
   </item>
   <item xsi:type="EM:ReferencedClaim" id="rc01" content="SAR Model is likely acceptable as input to automated risk assessment"/>
  <item xsi:type="EM:ReferencedClaim" id="rc02" content="Score of SAR OV is Medium"/>
<item xsi:type="EM:ReferencedClaim" id="rc03" content="Score of SAR CV scores is High"/>
<item xsi:type="EM:ReferencedClaim" id="rc04" content="Score of SAR DiV scores is High"/>
<item xsi:type="EM:ReferencedClaim" id="rc04" content="Score of SAR DiV scores is High"/>
<item xsi:type="EM:ReferencedClaim" id="rc04" content="Score of SAR DiV scores is High"/>
   <item xsi:type="EM:Document" id=doc06" name="SAR mission review" title="SAR Mission Review notes"/>
   <item xsi:type="EM:Document" id="doc07" name="SAR model issues"/>
   <property xsi:type="EM:RequiresContainer" container="ec01"/>
   <property xsi:type="EM:ContainerCompleteness" value="final"/>
   property xsi:type="EM:ContainerConsistency" value="formal"/>
  <element xsi:type="EM:Organization" name="KDM Analytics"/>
<element xsi:type="EM:Method" id="met01" name="DoDAF Analytics"/>
<element xsi:type="EM:Service" id="ser01" name="DoDAF mode review"/>
   <element xsi:type="EM:Activity" id="act01" name="Review DoDAF model" content="Validate that all performers and their operational</pre>
activities and operational exchanges have been correctly identified">
    <property xsi:type="EM:Satisfies" element="obj01"/>
<property xsi:type="EM:DependsOn" element="ser01"/>
   </element>
   <element xsi:type="EM:ProjectObjective" id="obj01" name="Evaluate input DoDAF model and establish its suitability for automated
risk assessment. Identify issues."/>
  <element xsi:type="EM:EvidenceRequest" id="req01" name="SAR model review document" content=""/>
<element xsi:type="EM:EvidenceRequest" id="req02" name="SAR mission objectives review" item="doc05 doc06">
    <timing xsi:type="EM:AtTime" datetime="30-07-2014 10:20"/>
    provenance xsi:type="EM:PerformedBy" executor="per03"/>
property xsi:type="EM:Satisfies" id="" element="act01"/>
   </element>
   <element xsi:type="EM:Tool" name="Blade Risk Manager" version="3.10">
       <property xsi:type="EM:Satisfies" element="met01"/>
<property xsi:type="EM:Satisfies" element="met02"/>
        <property xsi:type="EM:DependsOn" element="org03"/>
   </element>
 </evidence>
```

</SACM:AssuranceCase>



Figure 15.2 - ProjectActivities Class Diagram

15.3.1 Activity

Activity element represents an individual task that either needs to be performed during an evidence-related effort (planning purposes), or has been performed during the effort (tracking purposes). Activity element may own several properties that define its relationship to other Activities (dependencies), to ProjectObjective elements (motivation), to required CollectionMethods (required resources), and to associated EvidenceRequest elements (for the purpose of planning collection of certain exhibits). Activity element may also own Provenance and Timing properties.

Superclass

AdministrativeElement

Associations

- property:ActivityProperty[0..*] Additional properties of this activity.
- provenance:Provenance[0..*]
 Provenance of this activity.
- timing:TimingProperty[0..*] Timing properties of this activity.

ProjectObjective

Example

ProjectObjective element represents an individual project requirement of an evidence-related effort. Specific activities can be added that satisfy their requirements.

15.3.2

<element xsi:type="EM:ProjectObjective" id="obj01" name="Evaluate input DoDAF model and establish its suitability for automated risk assessment. Identify issues."/> <element xsi:type="EM:Activity" name="Review DoDAF model" content="Validate that all performers and their operational activities and operational exchanges have been correctly identified">

<property xsi:type="EM:Satisfies" element="obj01"/>
</element>

AdministrativeElement

Superclass

Attributes

text:String

Text of the project objective (prose).

Semantics

The text attribute of the ProjectObjective element specifies the project objective. In addition, the ProjectObjective element may own Description element.

15.3.2 EvidenceRequest

EvidenceRequest represents a placeholder for an EvidenceItem to be collected during the evidence-related effort.

	Superclass	Example
	ProjectElement	This example illustrates two evidence requests. The first evidence request is a
	Associations	second evidence request illustrates a completed element with reference to the set
45 2 4	• item:EvidenceItem[0*] Evidence items that satisfy the request.	of collected documents together with statement of timing and provenance.
15.3.4		
	15.3.3 CollectionMethod (abstract)	<pre><element content="" id="req01" name="SAR model review document" xsi:type="EM:EvidenceRequest"></element></pre>
	CollectionMethod is an abstract class that represe Model.	<pre><element id="req02" item="doc04 doc05" name="SAR mission objectives review" xsi:type="EM:EvidenceRequest"></element></pre>
	Superclass	<timing <u="" xsi:type="EM:AtTime">datetime="30-07-2014 10:20"/> <provenance executor="per03" xsi:type="EM:PerformedBy"></provenance></timing>
	Object	<pre><pre>cyclements</pre> </pre> <pre>Satisfies</pre> id="" element="act01"/>
	Semantics	<item <="" id="doc04" name="SAR mission review" th="" xsi:type="EM:Document"></item>
15.3.5	Defined by concrete subclasses and further throu	title="SAR Mission Review notes"/> <item id="doc05" name="SAR model issues" xsi:type="EM:Document"></item>
	15.3.4 Service	
	Service element represents an evidence collection	<pre><element <="" activity"="" id="act01" name="Review DoDAF model" pre="" xsi:type="EM:Activity"></element></pre>
	Superclass	operational exchanges have been correctly identified"/>
	CollectionMethod	
	Associations	

• tool:RequiresTool[0..*] Tool that is required by the service.

<element xsi:type="EM:ProjectObjective" id="obj01" name="Evaluate input DoDAF model and establish its suitability for automated risk assessment. Identify issues."/> <element xsi:type="EM:Activity" name="Review DoDAF model" content="Validate that all performers and their operational activities and operational exchanges have been correctly identified">

<property xsi:type="EM:Satisfies" element="obj01"/>
</element>

AdministrativeElement

Superclass

Attributes

text:String

Text of the project objective (prose).

Semantics

The text attribute of the ProjectObjective element specifies the project objective. In addition, the ProjectObjective element may own Description element.

15.3.2 EvidenceRequest

EvidenceRequest represents a placeholder for an EvidenceItem to be collected during the evidence-related effort.

Example

Superclass

ProjectElement

Associations

- item:EvidenceItem[0..*]
 Evidence items that satisfy the request.
- This example illustrates two evidence requests. The first evidence request is a placeholder for some action that will result in collecting am evidence item. The second evidence request illustrates a completed element with reference to the set of collected documents together with statement of timing and provenance.

15.3.3 CollectionMethod (abstract)

CollectionMethod is an abstract class that represents evidence collection methods as elements of meaning in the Evidence Model.

Superclass

Object

15.3.4

Semantics

15.3.5 Defined by concrete subclasses and further through a reference to an external vocabulary of ontology.

15.3.4 Service

Service element represents an evidence collection capability that can be provided by a person or an organization.

Superclass

CollectionMethod

Associations

• tool:RequiresTool[0..*] Tool that is required by the service.

Example <element xsi:type="EM:Service" id="ser01" name="DoDAF mode review"/>

Semantics

RequiresTool statement asserts a state of affairs that the tool identified as tool attribute of the RequiresTool object owned by Service object, is required by the Service object. Further detail may be provided through the Provenance and Timing clauses. Multiple OwnedBy attribute specifies multiple providers of the Service.

< 15.3.5 Method

15.3.6

Method element represents an evidence collection method that can be applied by a person or an organization. The scope of a Method may be creation, acquisition, and generation of evidence elements, transfer of evidence element, revocation of evidence elements, evaluation of evidence elements.

- Example

CollectionMethod

Associations

• tool:RequiresTool[0..*] Tool that is required by the method.

Semantics

RequiresTool statement asserts a state of affairs that the tool identified as tool attribute of the RequiresTool object owned by Method object, is required by the Method object. Further detail may be provided through the Provenance and Timing clauses. Multiple OwnedBy attribute specifies multiple providers of the Method.

Repeatable Security Assessment"/>

<mark>15.3.6</mark> Tool

Tool element represents an automated evidence collection or evidence generation capability that can be licensed by a person or an organization.

Superclass

CollectionMethod

Attibutes

version:String[1] Designation of the version of the tool.

<element xsi:type="EM:Method" id="met01" name="DoDAF Analytics"/>

<element xsi:type="EM:Method" id="met02" name="FORSA" content="Fact-Oriented"</pre>

15.3.8

15.3.7

15.3.7 Stakeholder (abstract)

Stakeholder is an abstract class that represents a Person or an Organization as they participate in the statements related to evidence.

Superclass

ProjectElement

The Evidence Metamodel indirectly defines several roles in which stakeholders are involved in evidence statements, such as Provenance statements and Custody statements. These roles include the "source" of an evidence item or an evidence assertion, the "supervisor" of an evidence assertion, the "owner" of an evidence item, the 'executor' of an evidence event and the "custodian" of an evidence item. This vocabulary facilitates exchange of structured statements related to evidence. Additional roles related to the affiliation of a stakeholder in some Organization can be defined by the corresponding community of interest. These roles can be used in HasRoleIn statements and exchanged informally, as the value of the 'role' attribute. On the other hand, formal statements related to stakeholders and their roles can be represented using the mechanism of Formal Statements. The fact type "stakeholder has role with respect to evidence item" can be formally defined outside of the Evidence Metamodel and then referred to for the purpose of constructing formal statements related to stakeholders.

15.3.9

<mark>≻<mark>15.3.8</mark> Person</mark>

An individual that can be the source of evidence items in various roles defined by the Evidence Metamodel. A person may be affiliated with an Organization.

Example

Superclass

Stakeholder

Associations

<element xsi:type="EM:Person" id="per03" name="Alice"/>

• affiliation:HasRoleIn[0..1] Affiliation of the Person with an Organization.

Semantics

HasRoleIn statement asserts a state of affairs that the Person identified as organization attribute of the HasRoleIn object owned by Person object, is the organization with which the Person is affiliated in the role identified as the 'role' attribute of the HasRoleIn object. Further detail may be provided through the Provenance and Timing clauses. For example, EffectiveTime clauses is added specifies the effective period of affiliation. Person may be affiliated with multiple organizations.

15.3.10

15.3.9 Organization

An organization that can be the source of evidence items in various roles defined by the Evidence Metamodel. Organization may be affiliated with another Organization.

Superclass

Stakeholder

Attributes

address:String The address of the Organization.

Associations

affiliation:HasRoleIn[0..1] Affiliation of the Organization with parent Organization.

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15.4 ProjectProperties Class Diagram

ProjectProperties class diagram defines several elements that represent various statements related project elements.



Figure 15.3 - ProjectProperties class diagram

15.4.1 ProjectProperty (abstract)

ProjectProperty represents statements related to the structure of ProjectElement. These statements are predicate clauses where the main clause describes some project element. The subject of the ProjectProperty clause is a ProjectElement.

Superclass

EvidenceProperty

Semantics

Defined by concrete subclasses