Semantic action

Tara Ontology Language

V1.3

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1.0 Introduction

Ontology defines a set of representational primitives that are used to model a domain of interest. Definitions of the representational primitives include information about their meaning, properties, and rules for their consistent use if needed.

Tara Ontology Language (Tara) provides a generic ontological foundation for modeling of business, social, and technology related processes and systems. Tara is an ontology representation language used to create ontologies. An ontology includes concepts, associations (relationships) and rules needed to build specific models within a domain of interest.

Tara is designed to be used by software that process information provided in Tara format and for this use Tara is interpreted via Tara XML schema (http://www.semantion.com/documentation/SBP/metamodeling/xsd/tara-1.3.xsd). Tara can also be used for presenting metamodeling information in more human friendly form and for this purpose Tara Language (TL) is used.

Semantion Metamodeler (SM2) is a tool that provides full ontology definitions in Tara.

The first release of Tara Ontology Language (former Tara Metamodeling Ontology) was published in December 2008:

http://www.semantion.com/documentation/SBP/metamodeling/TaraMetamodelingOntology_V1.0.pdf

2.0 Tara Elements

The elements of Tara Ontology Language (Tara) are:

- **Association**
- **AssociationRule**
- **Attribute**
- **Classification**
- **Concept**
- **ConceptRule**
- **InformationalReference**
- **Ontology**
- **Node**
- **Scheme**
- **SemanticDescription**
- **SubAssociation**
- **SubConcept**

2.1 Association

Association models an association between two ***Concepts***. ***Association*** has following properties:

Property Name	Property Description	Is property mandatory?
node	Association scheme node that belongs to the association. Association scheme contains all nodes representing association types used in the ontology.	Yes
associationRules	List of association rules that specify constraints under which the association can be used.	Yes

2.2 AssociationRule

AssociationRule models a rule for an Association. To be functional the rule specifies source concept type and target concept type of the association at least. **AssociationRule** has following properties:

Property Name	Property Description	Is property mandatory?
name	Name of the AssociationRule	Yes
description	Description of the AssociationRule	No
type	The type of the rule. If the *Tara* type is specified this rule is used. If any other type is specified then the rule represented by either property *content* or property *reference* below is used.	Yes
content	A rule content written in a rule language specified by the *type* property. If this property is used the *reference* property is ignored.	No
reference	An informational reference of a document containing the association rule. If this reference is specified then the rest of the rule properties listed below are ignored.	No
sourceType	Type of the source concept in the association.	No
sourceAttribute	Source concept attribute (property).	No
sourceValues	List of source concept attribute values.	No
targetType	Type of the target concept in the association.	No
targetAttribute	Target concept attribute (property).	No
targetValues	List of target concept attribute values	No
minimumCardinality	Specifies the minimum number of target concept instances the source concept instance has to be associated with.	No
maximumCardinality	Specifies the maximum number of target concept instances the source concept	No

	instance can be associated with.	
cardinality	Specifies the exact number of target concept instances the source concept instance has to be associated with.	No

The source concept type and target concept type are mandatory properties for the **AssociationRule** to be functional. They specify source concept and target concept in the association. Additional constraints can be added via attributes (properties) and their values. For example, we can have concept A and B where the concept A is the source concept and concept B is target concept in the association. By using the rule we can also specify that concept A and B can be associated only if a specific attribute of the concept A (*sourceAttribute* property of the **AssociationRule**) has required list of values (*sourceValues* property of the **AssociationRule**) and a specific attribute of the concept B (*targetAttribute* property of the **AssociationRule**) has required list of values (*targetValues* property of the **AssociationRule**).

Any number of **AssociationRules** can be defined for an **Association**.

An **AssociationRule** can be defined in another language as well. It can be contained in the *content* property or it can be referenced by the *reference* property that is an informational reference for a document containing the rule.

2.3 Attribute

Attribute models additional ***Concept's*** *properties*. These properties are any properties besides the default ***Concept's*** properties that include ***name***, ***description***, and ***nodes*** where ***nodes*** represents a list of all concept type nodes which the attribute belongs to. ***Attribute*** has following properties:

Property Name	**Property Description**	**Is property mandatory?**
name	Name of the Attribute	Yes
description	Description of the Attribute	No
values	List of property values. Default values can be specified.	No
type	Attribute's type (i.e., Integer, String, etc.)	No
option	A list of fixed pre-defined optional values	No
required	Specifies if the value for the property is mandatory (yes/no). If the value for this property is not specified the default value is "*no*".	No

2.4 Classification

Classification classifies ***Concepts*** based on common characteristics. ***Classification*** has following properties:

Property Name	**Property Description**	**Is property mandatory?**
name	Name of the classification	Yes
description	Description of the classification	No

node	Classification node	No
concept	Concept that is associated with the node via this classification	No

2.5 Concept

Concept models any physical or abstract thing that can have a computerized representation.

Property Name	**Property Description**	**Is property mandatory?**
node	Node that represents concept's type. This node is under the scheme that includes all concept type nodes.	Yes
attributes	List of concept's attributes	No
conceptRules	List of concept's rules	No

Node, attributes, and conceptRules are Tara constructs used to define a Concept. Node itself defines Concept's type specified by the name (type name) and description. *name* and *description* are default properties of Concept's instances. Additional properties can be added via Tara attributes.

2.6 ConceptRule

ConceptRule models a rule for a Concept. **ConceptRule** has following properties:

Property Name	**Property Description**	**Is property mandatory?**
name	Name of the ConceptRule	Yes
description	Description of the ConceptRule	No
type	The type of the rule.	Yes
content	A rule content written in a rule language specified by the *type* property. If this property is used the *reference* property is ignored.	No
reference	An informational reference of a document containing the concept rule.	No

2.7 InformationalReference

InformationalReference models a detailed reference to a document. **InformationalReference** has following properties:

Property Name	Property Description	Is property mandatory?
name	Name of the InformationalReference	Yes
description	Description of the InformationalReference	No
node	Node that represents document type	Yes
value	Document's reference	No
version	Version of the document represented by this InformationalReference	No
time	Time when InformationalReference is confirmed. The InformationalReference is confirmed when document becomes available. At that time, the *value* attribute of the InformationalReference gets the URI value representing the location of the document.	No
author	Author of the document which metadata is represented by the InformationalReference	No
title	The title of the document	No

2.8 Ontology

An **Ontology** models a specific domain of interest. It contains all concepts, associations, and rules needed to model domains of interest (i.e., processes, systems, and other things in business and social environments). Ontology has following properties:

Property Name	Property Description	Is property mandatory?
name	Name of the Ontology	Yes
description	Description of the Ontology	No
conceptScheme	Scheme that defines all concept types	No
associationScheme	Scheme that defines all association types	No
optionSchemes	List of schemes that define all options for attributes	No
concepts	List of concepts	No

associations	List of associations	No

2.9 Node

Node models a node under the classification scheme. ***Node*** has following properties:

Property Name	**Property Description**	**Is property mandatory?**
name	Name of the node	Yes
description	Description of the node	No
parent	Parent scheme's reference	No

2.10 Scheme

Scheme is a root node in a scheme of nodes. ***Scheme*** has following properties:

Property Name	**Property Description**	**Is property mandatory?**
name	Name of the scheme	Yes
description	Description of the scheme	No
type	Type of the scheme that reflects the purpose of the scheme (Association/Concept/Option/ Type/Document).	No
nodes	A list of nodes that belongs to the scheme	No

2.11 SemanticDescription

SemanticDescription models a formal (RDF, OWL, etc.) or informal description of a Concept or an Association or an entire Ontology.

Property Name	**Property Description**	**Is property mandatory?**
name	Name of the semantic description.	Yes
description	Description of the semantic description.	No
type	Type of the SemanticDescription (i.e., RDF, OWL, etc.)	Yes

content	Semantic description content.	No
reference	An informational reference of a document containing the semantic description.	No

2.12 SubAssociation

SubAssociation models an Association that has a parent Association. It is in the *HasSubassociation* Association, as a target object, with the parent Association.

2.13 SubConcept

SubCOncept models a Concept that has a parent Concept. The sub-concept inherits all properties of the parent concept. It is in the *HasSubconcept* Association, as a target object, with the parent Concept.

3.0 Inheritance, Inference, and Transitivity

In Tara, inheritance can be defined via "Inherits" association with a rule where the source concept type represents child concept while the target concept type represents parent concept.

Associations between concepts makes it possible to use logic to discover new information/knowledge. Concepts can be linked together either directly or indirectly. An asserted association is a direct association between two concepts. For example, "*B Inherits A*" means that concept B inherits all properties of concept A. Inferred associations are indirect associations between two concepts. These associations can be found by tracking associations between two concepts across the intervening concepts and associations which include multiple association types. Novel inferred associations can be found by traversing the asserted associations via association rules that govern the transitivity of associations in an ontology.

4.0 Ontology Definition

The definition of an ontology based on Tara includes following steps:

1. Create an ontology
2. Define concept types
3. Define association types
4. Define attribute types
5. Define optional property values (options) if needed
6. Define additional properties for concepts where needed
7. Define association rules
8. Define concept rules

9. Define document types

Tara Language (TL) or Tara XML schema can be used for formal ontology definitions. We will use formal model definitions in this document. Second part of this document will also show how Semantion Modeler can be used to create metamodels in Tara.

After creating an ontology, the concept types have to be defined first.

If the ontology contains associations, association types have to be modeled as well.

Define types that will be used as data types for attributes.

For properties that have pre-defined fixed optional values, these values have to be modeled too.

Attributes have to be defined for all concepts that require additional properties besides the default properties (name and description).

We also have to define association rule for each association used.

If concept rules are needed they will be defined as well.

Finally, if documents are used in a process/system ontology, document types have to be defined.

4.1 Ontology Definition Examples in Tara

Three examples of different complexity will be presented in this section. They are coded in Tara Language.

First example demonstrates how to model a customer with his/her contact information.

Second example shows how more complex association rules can be modeled.

The last example shows how to model decisions in business processes.

4.1.1 Customer

We will use four concepts to model a customer: Customer, PostalAddress, EmailAddress, and TelephoneNumber. By following Tara metamodeling steps we will define concepts, associations between them, optional properties' values, and additional properties via attributes, and attribute types. Document types will not be defined since they are not needed in this example.

4.1.1.1 Customer Concept Types Definitions

ConceptScheme {

name: Customer Concepts; **description**: This is a classification scheme for concept types;

{**name**: Customer; **description**: Customer type; }

{**name**: PostalAddress; **description**: PostalAddress type; }

{**name**: EmailAddress; **description**: EmailAddress type;}

{**name**: TelephoneNumber; **description**: TelephoneNumber type;}

}

4.1.1.2 Customer Association Types Definitions

AssociationScheme {

name: Customer Associations;

description: This is a classification scheme for association types;

{**name**: IsPostalAddressOf; **description**: Models association between PostalAddress and Customer;
rule: { **name**: PostalAddress-Customer;
description: Defines a rule for association between PostalAddress and Customer;
sourceType: PostalAddress; **targetType**: Customer;}
}

{**name**: IsEmailAddressOf; **description**: Models association between EmailAddress and Customer;
rule: { **name**: EmailAddress-Customer;
description: Defines a rule for association between EmailAddress and Customer;
sourceType: EmailAddress; **targetType**: Customer;}
}

{**name**: IsTelephoneNumberOf; **description**: Models association between TelephoneNumber and Customer;
rule: { **name**: TelephoneNumber-Customer;
description: Defines a rule for association between TelephoneNumber and Customer;
sourceType: TelephoneNumber; **targetType**: Customer;}
}

}

4.1.1.3 Optional Property Values Definitions

OptionSchemes {

{**name**: LocationValues;
description: This is a classification scheme for the PostalAddress, EmailAddress, and
ContactNumber location optional values;
{**name**: Office; **description**: Office location;}
{**name**: Home; **description**: Home location;}
}

{**name**: TelephoneNumberTypeValues;
description: This is a classification scheme for the telephone number type values;
{**name**: Phone; **description**: Land phone;}
{**name**: Cell; **description**: : Cell phone;}
{**name**: Fax; **description**: : Fax;}
}

{**name**: StateProvinceValues; **description**: This is a classification scheme for the State/Province values;
{**name**: Alberta;}
{**name**: British Columbia;}
{**name**: Manitoba;}
{**name**: New Brunswick;}
{**name**: Newfoundland and Labrador;}
{**name**: Northwest Territories;}
{**name**: Nova Scotia;}
{**name**: Nunavut;}

{**name**: Ontario;}
{**name**: Prince Edward Island;}
{**name**: Quebec;}
{**name**: Saskatchewan;}
{**name**: Yukon;}
}

}

4.1.1.4 Additional Properties Definitions

Attributes {

{**name**: firstName; **description**: Customer's first name;
required: yes;
type: String;
concepts: [Customer];}

{**name**: middleName; **description**: Customer's middle name;
type: String;
concepts: [Customer];}

{**name**: lastName; **description**: Customer's last name;
required: yes;
type: String;
concepts: [Customer];}

{**name**: street; **description**: Street name;
required: yes;
type: String;
concepts: [PostalAddress];}

{**name**: streetNumber; **description**: Street number;
required: yes;
type: String;
concepts: [PostalAddress];}

{**name**: city; **description**: City name;
required: yes;
type: String;
concepts: [PostalAddress];}

{**name**: stateOrProvince; **description**: State/Province name;
option: StateProvinceValues;
required: yes;
concepts: [PostalAddress];}

{**name**: postalCode; **description**: Postal code;

required: yes;
type: String;
concepts: [PostalAddress];}

{**name**: country; **description**: Country name;
option: CountryValues;
required: yes;
type: String;
concepts: [PostalAddress];}

{**name**: address; **description**: Email address;
concepts: [EmailAddress];}

{**name**: number; **description**: Telephone number;
required: yes;
type: String;
concepts: [TelephoneNumber];}

{**name**: locationType; **description**: Location type;
option: LocationValues;
concepts: [EmailAddress, TelephoneNumber];}

{**name**: type; **description**: Telephone number type;
option : TelephoneNumberTypeValues;
concepts: [TelephoneNumber];}

}

We do not list all attributes here. We listed just few of them to show how they can be created.

4.1.1.5 Customer Modeling in Tara

At this point we have a small ontology for modeling information about our customers. Now, we are ready to model the "John Smith" customer using the ontology we just created:

Concepts {

{ **name*:*** *John Smith;* **description*:*** *A customer;*
node*: Customer;* **firstName*:*** John***; middleName:; lastName:*** *Smith****;***
{ *PostalAddress #IsPostalAddressOf;*
PhoneNumber #IsTelephoneNumberOf;
FaxNumber #IsTelephoneNumberOf;
EmailAddress #IsEmailAddressOf;
}
}

{ **name*:*** *PostalAddress;* **description*:*** John Smith's postal address;
node*: PostalAddress;* **streetNumber*:*** 15***;*** **street**: Lake Avenue;

city: Toronto; **stateOrProvince**: Ontario;
postalCode: M9A 2C2; **country**: Canada;
}

{ **name*:*** *PhoneNumber;* **description*:*** John Smith's phone number;
node*:* TelephoneNumber*;* **number*:*** 416-123-4567*;* ***type****: Phone;*
}

{ **name*:*** *FaxNumber;* **description*:*** John Smith's fax number;
node*:* TelephoneNumber*;* **number*:*** 416-123-5555***;*** ***type****: Fax;*
}

{ **name*:*** *EmailAddress;* **description*:*** John Smith's email address;
node*: EmailAddress;* **address*:*** john.smith@semantion.com***;***
}
}

4.1.2 Association Rule

Each association needs at least one rule that defines its source concept type and target concept type. However, sometimes additional constraints need to be specified. For example, let us assume that we have two concepts, C1 and C2 that need to be associated with "*RelatesTo*" association type where *C1* is the source concept in the association and *C2* is the target concept in the association. Besides name and description property *C1* also has two additional properties, *c1p1* and *c1p2*. *C2* concept has also two additional properties *c2p1* and *c2p2*.

We need to define a following rule: *C1* will be associated with *C2* only if *C1's* property modeled with attribute *c1p1* has value *v1* and *C2's* property modeled with attribute *c2p1* has value *v2*. This is how the association definition will look in TL:

AssociationScheme {
name: Associations;
description: This is a classification scheme for association types. Only one association type "RelatesTo" is defined for now.

{**name**: RelatesTo; **description**: Models association between C1 and C2;
rule: {**sourceType**: C1; **targetType**: C2;
sourceAttribute: c1p1; **sourceValue**: [v1];
targetAttribute: c2p1; **targetValue**: [v2];
}
}
}

4.1.3 Decision

We will define only a small fragment of the SOA Information Model (SOA-IM) ontology [1] that will be used to model business process decisions.

In order to define (create) an ontology (a small fragment of SOA-IM in this example) that will be used to model decisions in business processes, we will follow five Tara metamodeling steps. The definitions specified in these steps are generic for the entire ontology. They are done just once during this definition phase of the ontology and then they are used to model entities supported by the ontology.

Before we define a small part of the SOA-IM ontology that will be used to model decisions in business processes, we will first extract the Decision definition from the SOA-IM ontology specification.

A *Decision* is a specific activity in a collaborative process flow that makes choices. *Decisions* are supplied with inputs called *Criteria* and they create outputs called *Choices*. A *Decision* can be made by any of these three participants in a collaborative process: *User* (human), *Service*, or *Agent*.

There are three types of decision outputs (alternatives):

- *Binary*
- *Primary*
- *Derivative*

The *Binary* outputs belong to a choice (e.g., *Yes* or *No*, *True* or *False*, etc.) and only a single output (choice) is generated based on a rule associated with the decision. The *Primary* type enables a selection of one or more outputs (but not all of them) from the provided inputs based on a rule associated with the *Decision*. The *Primary* type outputs provide filtering. The *Derivative* type is like the *Binary* type with a difference that it can generate more than one output based on a rule associated with the *Decision*.

This is a minimized list of Concepts needed to model a *Decision* in SOA-IM:

- *Choice*
- *ChoiceReference*
- *InformationalReference*
- *InputOutput*
- *Decision*
- *Service*

Choice models decision's choices*, ChoiceReference* models a reference of the document that models a choice that can be produced by the decision*, InformationalReference* models a reference to a document associated with an *InputOutput*, *InputOutput* models decision's criteria (inputs), *Decision* concept models decision*, and Service* models a service that will perform the decision. In this example we assume that the *Decision* will be performed by a *Service*. Some concepts and attributes have been removed from the definitions below to make this example simpler and easier to understand.

This is how SOA-IM defines these Concepts:

Choice

Attribute	***Type***	***Description***
id	String256	Unique ID
name	String256	Choice's name
description	String4000	Detailed description
alias	String256	The alias of the Choice. For example, if the alias is specified it will be used as a parameter name for a service which the Choice is associated with. Otherwise the name attribute will be used without spaces between the words included in the name.
time	DateTime	Time when Choice is confirmed

Associated with

- A Decision where the Decision is the target object and association type is "IsChoiceOf"

ChoiceReference

Attribute	***Type***	***Description***
id	String256	Unique ID
name	String256	ChoiceReference's name

description	String4000	Detailed description
type	String256	Document type (any type)
value	String256	Document's reference
time	DateTime	Time when ChoiceReference is confirmed

Associated with
- A Choice where the Choice is the target object and association type "IsChoiceReferenceFor"

InformationalReference

Attribute	***Type***	***Description***
id	String256	Unique ID
name	String256	InformationalReference's name
description	String4000	Detailed description
type	String256	Type of the referenced document (any document type or ChoiceDoc)
value	String256	Document's reference
time	DateTime	Time when InformationalReference is confirmed

Associated with
- A Criterion where the Criterion is the target object and association type is "IsReferenceFor"
- An InputOutput where the InputOutput is the target object and association type is "IsReferenceFor"

InputOutput

Attribute	***Type***	***Description***
id	String256	Unique ID
name	String256	The name of the InputOutput.
description	String4000	Detailed description
alias	String256	The alias of the InputOutput. For example, if the alias is specified it will be used as a parameter name for a service which the InputOutput is associated with. Otherwise the name attribute will be used without spaces between the words included in the name.
type	String256	The type of InputOutput (Input/Output/Both)
time	DateTime	Time when InputOutput is confirmed

Associated with
- A Decision where the Decision is the target object and association type is "IsCriterionOf"

Decision

Attribute	***Type***	***Description***
id	String256	Unique ID
name	String256	Decision's name
description	String4000	Detailed description
choiceType	String256	The type of the decision's choices (Binary/Primary/Derivative)
timeToComplete	String256	A period of time for which the decision must be completed. If the value for this attribute is not provided the time to complete is unlimited. The value for this attribute is specified using the XSD duration format (e.g., PT1H means one hour).

Associated with
- A CollaborativeProcessFlow where the CollaborativeProcessFlow is the target object and association type is "IsDecisionIn".

Service

Attribute	***Type***	***Description***
id	String256	Unique ID
name	String256	Service's name
description	String4000	Detailed description
protocol	String256	The ID of the protocol used to communicate with the service (WSDL, CPPA, etc.).
modelReference	String256	The reference for the document that contains service logic in the original service modeling language format (UML, BPMN, text or other).
rule	String256	The ID of a Rule that the decision type services will use in making a decision.

Associated with
- A Decision where the Decision is the target object and association type is "IsServiceFor"

Now we will provide all definitions needed to define the fragment of SOA-IM for the decisions' metamodeling.

4.1.4.1 Concept Types Definitions

ConceptScheme {

name: SOA-IM Concepts; **description**: This is a classification scheme for concept types;

{**name**: Choice; **description**: Choice type; }

{**name**: ChoiceReference; **description**: ChoiceReference type; }

{**name**: InformationalReference; **description**: InformationalReference type;}

{**name**: InputOutput; **description**: InputOutput type;}

{**name**: Decision; **description**: Decision type;}

{**name**: Service; **description**: Service type;}

}

4.1.4.2 Association Types Definitions

AssociationScheme {

name: SOA-IM Associations; **description**: This is a classification scheme for association types;

{**name**: IsChoiceOf; **description**: Models association between Decision and Choice;

rule: {**sourceType**: Choice; **targetType**: Decision;}

}

{**name**: IsChoiceReferenceFor; **description**: Models association between Choice and ChoiceReference;

rule: { **name**: ChoiceReference-Choice;

description: Defines a rule for association between ChoiceReference and Choice;

sourceType: ChoiceReference; **targetType**: Choice;}

}

{**name**: IsReferenceFor; **description**: Models association between InputOutput and InformationalReference;

rule: { **name**: InformationalReference - InputOutput;

description: Defines a rule for association between InformationalReference and InputOutput;
sourceType: InformationalReference; **targetType**: InputOutput;}
}
{**name**: IsCriterionOf; **description**: Models association between Criterion and Decision;
rule: { **name**: Criterion - Decision;
description: Defines a rule for association between Criterion and Decision;
sourceType: Criterion; **targetType**: Decision;}
}
{**name**: IsServiceFor; **description**: Models association between Service and Decision;
rule: { **name**: Service - Decision; **description**: Defines a rule for association between Service and Decision;
sourceType: Service; **targetType**: Decision;}
}
}

4.1.4.3 Fixed Optional Property Values Definitions

OptionSchemes {
{**name**: ChoiceTypeValues;
description: This is a classification scheme for the choiceType property optional values;
{**name**: Binary; **description**: Binary choice type;}
{**name**: Primary; **description**: Primary choice type;}
{**name**: Derivative; **description**: Derivative choice type;}
}

{**name**: InputOutputValues;
description: This is a classification scheme for the InputOutput values;
{**name**: Input; **description**: InputOutput models input only;}
{**name**: Output; **description**: : InputOutput models output only;}
{**name**: Both; **description**: : InputOutput models both input and output;}
}

{**name**: MimeTypeValues;
description: This is a classification scheme for the mimeType property optional values;
{**name**: text/xml; **description**: Binary choice type;}
{**name**: text/plain; **description**: Primary choice type;}
{**name**: application/msword; **description**: Derivative choice type;}
{**name**: application/pdf; **description**: Derivative choice type;}
}

{**name**: ProtocolValues;
description: This is a classification scheme for the service's protocol property optional values;
{**name**: CPID; **description**: Collaborative Process Information Document based protocol;}
{**name**: WSDL; **description**: Web Services Description Language based protocol;}
{**name**: CPPA; **description**: Collaborative Protocol Profile and Agreement based protocol;}
}
}

4.1.4.4 Additional Properties Definitions

Attributes {

{**name**: alias;
description: The alias of the Choice. For example, if the alias is specified
it will be used as a parameter name for a service which the Choice
is associated with. Otherwise the name attribute will be used without
spaces between the words included in the name.;
concepts: [Choice, InputOutput];}
{**name**: choiceType; **description**: The type of the decision's choices (Binary/Primary/Derivative);
option: ChoiceTypeValues;
required: yes;
concepts: [Choice];}
{**name**: url; **description**: The URL of the document that will be accessed on-line;
concepts: [ChoiceYes, ChoiceNo];}
{**name**: type; **description**: InputOutput types;
option: InputOutputValues;
required: yes;
concepts: [InputOutput];}
{**name**: type; **description**: Reference types;
required: yes;
concepts: [ChoiceReference, InformationalReference];}

}

We do not list all attributes here. We listed just few of them to show how they can be created.

4.1.4.5 Document Types Definitions in Tara

DocumentScheme {

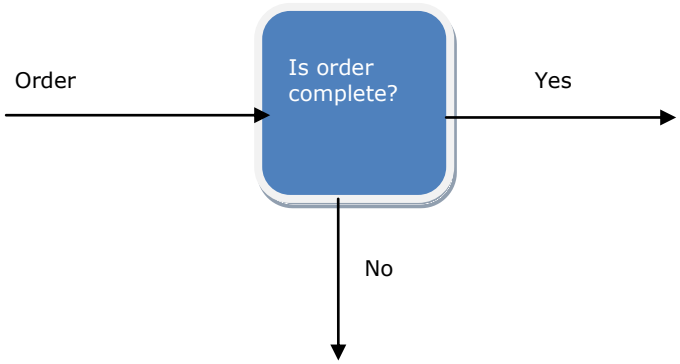
name: DocumentType;
description: This is a classification scheme for document types that will be used with the "Is odrder complete"
decision example;
{**name**: ChoiceYes; **description**: XML document type that contains "yes" choice;}
{**name**: ChoiceNo; **description**: XML document type that contains "no" choice;}
{**name**: Order; **description**: XML document type that contains an order;}

}

4.1.4.6 Decision Modeling in Tara

In the previous sections we defined an ontology in Tara that will be used to model decisions in business processes.

Now we are ready to model a concrete decision we call *"Is order complete?"*. First we'll model the order via *InputOutput* and *InformationalReference*. During the execution of a process the decision will check the order and if it is correct and complete it will generate the "Yes" choice. Otherwise the generated choice will be "No". This decision is performed by a service.



The following Tara listing represents all Concepts that model the *"Is order complete?"* decision:

```
Concepts {
    { name: Order; description: An order that will be processed;
      node: InputOutput; alias: order;
      type: Both; time:;
      { name: OrderInfoRef; description: Order's informational reference;
        node: InformationalReference; alias: order;
        type: Order; value:;
      } #IsReferenceFor;
    }

    { name: ChoiceYes; description: Concept that represents "Yes" choice;
      node: Choice; alias: ChoiceYes; time:;
      { name: ChoiceYesRef; description: Choice yes' reference;
        node: ChoiceReference; type: ChoiceYes;
        value:;
      } #IsChoiceReferenceFor;
    }

    { name: ChoiceNo; description: An Concept that represents "No" choice;
      node: Choice; alias: ChoiceNo;
      time:;
      { name: ChoiceNoRef; description: Choice no's refrence;
        node: ChoiceReference; type: ChoiceNo;
        value:;
      } #IsChoiceReferenceFor;
    }

    { name: IsOrderComplete; description: Service that will perform "Is order complete" decision;
      node: Service; protocol: WSDL;
      modelReference:; rule:;
    }

    { name: Is order complete?;
      description: Checks if an order is complete. If the order is complete makes "Yes" choice. Otherwise
```

```
                    makes "No" choice. This decision must be completed in 5 minutes;
            node: Decision; choiceType: Binary;
            timeToComplete: PT5M;
            {   Order #IsCriterionOf;
                ChoiceYes #IsChoiceOf;
                ChoiceNo #IsChoiceOf;
                IsOrderComplete #IsServiceFor;
            }
        }
    }
```

This model of the *"Is order complete"* decision is ready for the execution on Semantion SOA Virtual Machine (SOA-VM).