

Mapping Rule between CSML 3.0 and CSML 3.0 Ontology

19/Sep/2006

Release Candidate 1

This document edited by Masao Nagasaki

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Mapping Rule between CSML3.0 Ontology to CSML3.0 XML Schema

This document describes the mapping rule between CSML3.0 Ontology to CSML3.0 XML Schema.

Each class in CSML Ontology (shortly CO) is not directly converted into a unique tag in XML schema. Instead, all child classes of entity, process, connector, and fact are converted into the entity, process, connector and fact tag with “type” and “typeID” attributes, respectively.

In the “type” attribute, the subclass name is specified. The name is created by joining all names of the parent classes with “:”. For example describing a complex class, <entity type=”csml-element:entity:biological:object:complex”>. With the description, the name of the type is too long, for shorter notation, a unique id is predefined. The id can be specified in the “typeID” attribute.

In the OWL definition, a slot of a class can take a primitive data type or an instance of a class. For a class, the cardinality of the slot can be multiple for some case. Depends on these properties of a slot, the conversion strategy to CSML3.0 format is changed.

If the cardinality of a slot is zero or once and the slot takes a primitive data type, the slot is converted into an attribute of the class.

If the cardinality of a slot is one or more and the slot takes a primitive data type, the slot is converted into set of tags with the slot name.

If the slot takes an instance of a class, the slot is basically converted into the tag with the slot name. In OWL, if the slot takes an instance of a class, the instance can be (i) directly defined in the slot or (ii) can be defined separately and referenced with “rdf:resource” attribute. This is one of the cause of flexible description with OWL. For restricting the format structure, in CSML3.0 schema, a slot in a class is converted to support just (i), just (ii), or both (i) and (ii). If a slot in a class is restricted to be converted into (ii) and the cardinality of the slot is zero or one, then the reference to an instance will be converted into an attribute, e.g. the ENTITY slot in the Connector class.

The conversion rule for each slot is summarized from the next section.

Mapping Rule for Each Classes

1 Top Level Class

CSMLBase

Instantiation	False
Properties	None.

2 Second Level Classes

AnimationBase

Instantiation	False
Properties	None.

BiologicalBase

Instantiation	False		
Properties	slot	range	mapping
	COMMENT	Comment{0,}	<comments> <comment> </comment>

ChartBase

Instantiation	False
Properties	None.

Comment

Used	ElementBase, EntityBiological, Model, View, GlobalShape, Chart, BiologicalBase, ExternalReferenceBase		
Properties	slot	range	mapping
	COMMENTTYPE	(RDF annotation xhtml text){0,1}	commentType
	NAME	string{0,1}	name
	CONTENTS	string{0,1}	CONTENTS

ElementBase

Instantiation	False		
Properties	slot	range	description
	COMMENT	Comment{0,}	<comments> <comment/> </comments>
	DATASOURCE	DataSource{0,}	<dataSource>

	ID	string	id
	NAME	string	name
	PUBLICATIONXREF	PublicationXref{0,}	refPublicationXref
	RELATIONSHIPXREF	RelationshipXref{0,}	refRelationshipXref
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref
	VIEWPROPERTY	ViewProeprty{0,1}	<viewProperty>

ElementMerge

Used	ImportModel		
Properties	slot	range	description
	MERGETYPE	string	mergeType
	PARAMETER		<parameter>

ExternalReferenceBase

Instantiation	False		
Properties	slot	range	description
	COMMENT	Comment{0,}	<comments> <comment/> </comments>

Filter

Used	SubModel, ImportModel, Filter, GlobalShape, GlobalAnimationProperty		
Properties	slot	range	description
	FILTERTYPE	string	filterType
	FILTER	Filter{0,}	<filter>
	PARAMETER		<parameter>
	SELECTION	Selection{0,}	<selection>

ImportModel

Definition	For importing the model of another project to current project.		
Comment			
Parent	CSMLBase		
Instantiation	True		
Used	Model		
Properties	slot	range	description
	ANIMATIONPROPERTY	AnimationProperty{0,}	<animationProperty>
	ELEMENTMERGE	ElementMerge{0,}	<elementMerge>
	ENTITYMAP	EntityMap{0,}	<entityMap>

	FACTMAP	FactMap{0,}	<factMap>
	PROCESSMAP	ProcessMap{0,}	<processMap>
	SELECTION	Selection{0,}	<selection>
	VIEWPROPERTY	ViewProperty{0,}	<viewProperty>

LogBase

Instantiation	False
---------------	-------

MapBase

Instantiation	False									
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>mapping</th> </tr> </thead> <tbody> <tr> <td>FROMELEMENT</td> <td>BaseElement</td> <td>fromRefID</td> </tr> <tr> <td>TOELEMENT</td> <td>BaseElement</td> <td>toRefID</td> </tr> </tbody> </table>	slot	range	mapping	FROMELEMENT	BaseElement	fromRefID	TOELEMENT	BaseElement	toRefID
slot	range	mapping								
FROMELEMENT	BaseElement	fromRefID								
TOELEMENT	BaseElement	toRefID								

Model

Instantiation	True																																										
Used	Project																																										
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>mapping</th> </tr> </thead> <tbody> <tr> <td>COMMENT</td> <td>Comment{0,}</td> <td><comments> <comment/*> </comments></td> </tr> <tr> <td>ENTITY</td> <td>Entity{0,}</td> <td><entitySet> <entity*> </entitySet></td> </tr> <tr> <td>FACT</td> <td>Fact{0,}</td> <td><factSet> <fact*> </factSet></td> </tr> <tr> <td>IMPORTMODEL</td> <td>ImportModel{0,}</td> <td><importModel>*</td> </tr> <tr> <td>LOGGEDPROPERTY</td> <td>LoggedProperty{0,1}</td> <td><loggedProperty>*</td> </tr> <tr> <td>MODELSIMULATIONPROPERTY</td> <td>ModelSimulationProperty{0,1}</td> <td><modelSimulationProperty>{0,1}</td> </tr> <tr> <td>MODELID</td> <td>string{0,1}</td> <td>modelID{0,1}</td> </tr> <tr> <td>MODELVERSIONID</td> <td>string{0,1}</td> <td>modelVersionID{0,1}</td> </tr> <tr> <td>NAME</td> <td>string{0,1}</td> <td>name{0,1}</td> </tr> <tr> <td>ORGANISM</td> <td>Organism{0,}</td> <td>refOrganismID</td> </tr> <tr> <td>PH</td> <td>float{0,1}</td> <td>pH</td> </tr> <tr> <td>PROCESS</td> <td>Process{0,}</td> <td><processSet> <process*> </processSet></td> </tr> <tr> <td>TEMPERATURE</td> <td>float{0,}</td> <td>temperature</td> </tr> </tbody> </table>	slot	range	mapping	COMMENT	Comment{0,}	<comments> <comment/*> </comments>	ENTITY	Entity{0,}	<entitySet> <entity*> </entitySet>	FACT	Fact{0,}	<factSet> <fact*> </factSet>	IMPORTMODEL	ImportModel{0,}	<importModel>*	LOGGEDPROPERTY	LoggedProperty{0,1}	<loggedProperty>*	MODELSIMULATIONPROPERTY	ModelSimulationProperty{0,1}	<modelSimulationProperty>{0,1}	MODELID	string{0,1}	modelID{0,1}	MODELVERSIONID	string{0,1}	modelVersionID{0,1}	NAME	string{0,1}	name{0,1}	ORGANISM	Organism{0,}	refOrganismID	PH	float{0,1}	pH	PROCESS	Process{0,}	<processSet> <process*> </processSet>	TEMPERATURE	float{0,}	temperature
slot	range	mapping																																									
COMMENT	Comment{0,}	<comments> <comment/*> </comments>																																									
ENTITY	Entity{0,}	<entitySet> <entity*> </entitySet>																																									
FACT	Fact{0,}	<factSet> <fact*> </factSet>																																									
IMPORTMODEL	ImportModel{0,}	<importModel>*																																									
LOGGEDPROPERTY	LoggedProperty{0,1}	<loggedProperty>*																																									
MODELSIMULATIONPROPERTY	ModelSimulationProperty{0,1}	<modelSimulationProperty>{0,1}																																									
MODELID	string{0,1}	modelID{0,1}																																									
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NAME	string{0,1}	name{0,1}																																									
ORGANISM	Organism{0,}	refOrganismID																																									
PH	float{0,1}	pH																																									
PROCESS	Process{0,}	<processSet> <process*> </processSet>																																									
TEMPERATURE	float{0,}	temperature																																									

	PUBLICATIONXREF	PublicationXref{0,}	refPublicationXref
	RELATIONSHIPXREF	RelationshipXref{0,}	refRelationshipXref
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref

Parameter

Used	Filter, ElementMerge, Variable, ProcessKinetic, ModelSimulationProperty, ConnectorKinetic		
Properties	slot	range	mapping
	KEY	string	key
	TYPE	string{0,1}	type{0,1}
	VALUE	string	value

Project

Instantiation	True		
Used			
Properties	slot	range	mapping
	CHART	Chart{0,}	<chartSet> <chart/*> </chartSet>
	GLOBALANIMATIONPROPERTY	GlobalAnimationProperty{0,1}	<globalSimulationProperty/>{0,1}
	GLOBALSIMULATIONPROPERTY	GlobalSimulationProperty{0,1}	<globalSimulationProperty/>{0,1}
	GLOBALVIEWPROPERTY	GlobalViewProperty{0,1}	<globalViewProperty/>{0,1}
	MODEL	Model	<model/>{0,1}
	NAME	string{0,1}	name{0,1}
	SUBMODEL		<subModelSet> <subModel/*> </subModelSet>
	VIEW	View{0,}	<viewSet> <view/*> </viewSet>
	BIOLOGICALEVENT	BiologicalEvent{0,}	<globalBiologicalProperty> <biologicalEvent/*> </globalBiologicalProperty>
	CELLCOMPONENT	CellComponent{0,}	<globalBiologicalProperty> <cellComponent/*> </globalBiologicalProperty>

			ery>
	CELLTYPE	CellType{0,}	<globalBiologicalProperty> <cellType/*> </globalBiologicalProperty>
	EVIDENCECODE	EvidenceCode{0,}	<globalBiologicalProperty> <evidenceCode/*> </globalBiologicalProperty>
	EXPERIMENTALFORMTYPE	ExperimentalFormType{0,}	<globalBiologicalProperty> <experimentalFormType/*> </globalBiologicalProperty>
	FEATUERTYPE	FeatureType{0,}	<globalBiologicalProperty> <featureType/*> </globalBiologicalProperty>
	ORGANISM	Organism{0,}	<globalBiologicalProperty> <organism/*> </globalBiologicalProperty>
	TISSUE	Tissue{0,}	<globalBiologicalProperty> <tissue/*> </globalBiologicalProperty>

Property

Used	LoggedProperty, Chart, RefChart, Fact		
Properties	slot	range	mapping
	KEY	string	key.
	VALUE	string	value

Selection

Used	SubModel, ImportModel, Filter, GlobalShape, GlobalAnimationProperty		
Properties	slot	range	mapping
	ELEMENT	ElementBase	refElement
	INCLUDECHILD	boolean	includeChild

SimulationBase

Properties	None.
------------	-------

SubModel

Used	Project		
Propertie s	slot	range	mapping
	FILTER	Filter{0,}	<filter/>
	PH	float{0,1}	<biologicalProperty pH=""/>
	LOGGEDPROTPERTY	LoggedProperty{0,1}	<loggedProperty/>
	MODELSIMULATIONPROPE RTY	ModelSimulationPrope rty {0,1}	<modelSimulationPropert y/>
	MODELID	String{0,1}	modelID
	MODELVERSIONID	String{0,1}	modelVersionID
	ORGANISM	Organism{0,}	<biologicalProperty organism=""/>
	SELECTION	Selection{0,}	<selection/>
	TEMPERATURE	float{0,}	<biologicalProperty temperature=""/>
	PUBLICATIONXREF	PublicationXref{0,}	refPublicationXref.
	RELATIONSHIPXREF	RelationshipXref{0,}	refRelationshipXref
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref

ViewBase

Instantiation	False
---------------	-------

3 SubClasses of AnimationBase

✚ AnimationProperty

Used	Connector, Process, Entity, SimulationRestriction, ImportModel, RefElement		
Properties	slot	range	mapping
	ANIMATIONID	string	animationID
	SVGANIMATION	string	<svg:svg> <svg:animation/> </svg:svg>

✚ GlobalAnimationProperty

Used	Project		
Properties	slot	range	mapping
	ANIMATIONID	string	AnimationID
	FILTER	Filter{0,}	<filter>*
	SELECTION	Selection{0,}	<selection>*
	SVGANIMATION	string	<svg:svg> <svg:animation/> </svg:svg>

4 SubClasses of BiologicalBase

✚ OpenControlledVocabulary

Instantiation	False		
Properties	slot	range	mapping
	TERM	string{0,}	term
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref

✚ ChemicalStructure

Used	SmallMolecule		
Properties	slot	range	mapping
	STRUCTUREDATA	string	structureData
	STRUCTUREFORMAT	(CML SMILES inCHI)	structureFormat

✚ Confidence

Used	Evidence		
Properties	slot	range	mapping
	CONFIDENCEVALUE	string{0,1}	confidenceValue
	PUBLICAIONXREF	PublicaionXref{0,}	refPublicationXref

✚ DeltaGprimeO

Used	ProcessBiological		
Properties	slot	range	mapping
	DELTA GPRIME-O	float	deltaGPrimeO
	IONICSTRENGTH	float{0,1}	ionicStrength
	PH	float{0,1}	pH
	PMG	float{0,}	pmg
	TEMPERATURE	float{0,1}	temperature

✚ Evidence

Used	ProcessBiological		
Properties	slot	range	mapping
	CONFIDENCE	Confidence{0,}	<confidence>
	EVIDENCECODE	EvidenceCode{0,}	refEvidenceCodeID
	EXPERIMENTALFORM	ExperimentalFormType{0,}	<experimentalForm>
	PUBLICAIONXREF	RelationshipXref{0,}	refPublicationXref
	RELATIONSHIPXREF	RelationshipXref{0,}	refRelationshipXref
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref

✚ ExperimentalForm

Used	Evidence		
Properties	slot	range	mapping
	ENTITY	Entity	refID
	EXPERIMENTALFORMTYPE	ExperimentalFormType{1,}	refExperimentalFormType

✚ KPrime

Used	KPrime, ProcessBiological		
Properties	slot	range	mapping
	IONICSTRENGTH	float{0,}	ionicStrength
	KPRIME	float{0,}	kPrime
	PH	float{0,}	pH
	PMG	float{0,}	pmg
	TEMPERATURE	float{0,1}	temperature

✚ PathwayStep

Definition	
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Comment										
Parent	BiologicalBase									
Instantiation										
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>description</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	slot	range	description						
slot	range	description								

SequenceFeature

Used	Dna, Rna, Protein																																
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>mapping</th> </tr> </thead> <tbody> <tr> <td>FEATURETYPE</td> <td>FeatureType{1}</td> <td>refFeatureTypeID</td> </tr> <tr> <td>NAME</td> <td>Name{0,1}</td> <td>name</td> </tr> <tr> <td>PUBLICAIONXREF</td> <td>PublicationXref{0,}</td> <td>refPublicationXref</td> </tr> <tr> <td>RELATIONSHIPXREF</td> <td>RelationshipXref{0,}</td> <td>refRelationshipXref</td> </tr> <tr> <td>SEQUENCEINTERVAL</td> <td>SequenceInterval{0,}</td> <td>sequenceInterval</td> </tr> <tr> <td>SEQUENCESITE</td> <td>SequenceSite{0,}</td> <td>sequenceSite</td> </tr> <tr> <td>SHORTNAME</td> <td>string{0,1}</td> <td>shortName</td> </tr> <tr> <td>SYNONYMS</td> <td>string{0,}</td> <td>synonym</td> </tr> <tr> <td>UNIFICATIONXREF</td> <td>UnificationXref{0,}</td> <td>refUnificationXref</td> </tr> </tbody> </table>	slot	range	mapping	FEATURETYPE	FeatureType{1}	refFeatureTypeID	NAME	Name{0,1}	name	PUBLICAIONXREF	PublicationXref{0,}	refPublicationXref	RELATIONSHIPXREF	RelationshipXref{0,}	refRelationshipXref	SEQUENCEINTERVAL	SequenceInterval{0,}	sequenceInterval	SEQUENCESITE	SequenceSite{0,}	sequenceSite	SHORTNAME	string{0,1}	shortName	SYNONYMS	string{0,}	synonym	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref		
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SEQUENCEINTERVAL	SequenceInterval{0,}	sequenceInterval																															
SEQUENCESITE	SequenceSite{0,}	sequenceSite																															
SHORTNAME	string{0,1}	shortName																															
SYNONYMS	string{0,}	synonym																															
UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref																															

SequenceLocation

Instantiation	False
---------------	-------

SubClasses of BiologicalEvent

CellularEvent

Used	ProcessBiological, FactBiological, Project, Model (They use the parent class BiologicalEvent).
Properties	None.

MolecularEvent

Used	ProcessBiological, FactBiological, Project, Model (They use the parent class BiologicalEvent).
Properties	None.

OrganismEvent

Used	ProcessBiological, FactBiological, Project, Model (They use the parent class BiologicalEvent).
Properties	None.

✚ PhysiologicalEvent

Used	ProcessBiological, FactBiological, Project, Model (They use the parent class BiologicalEvent).
Properties	None.

SubClasses of BiologicalRole

✚ CellRole

Used	EntityBiological, InputAssociationBiological, InputInhibitorBiological, OutputProcessBiological, Model, SubModel (They use parent class BiologicalRole).
Properties	None.

✚ MoleculeRole

Used	EntityBiological, InputAssociationBiological, InputInhibitorBiological, OutputProcessBiological, Model, SubModel (They use parent class BiologicalRole).
Properties	None.

✚ OrganismRole

Used	EntityBiological, InputAssociationBiological, InputInhibitorBiological, OutputProcessBiological, Model, SubModel (They use parent class BiologicalRole).
Properties	None.

✚ PhysiologicalRole

Used	EntityBiological, InputAssociationBiological, InputInhibitorBiological, OutputProcessBiological, Model, SubModel (They use parent class BiologicalRole).
Properties	None.

SubClasses of OpenControlledVocabulary

✚ BiologicalEvent

Properties	None.
------------	-------

✚ BiologicalRole

Properties	None.
------------	-------

✚ CellComponent

Definition	A cellular location.
Comment	
Parent	OpenControlledVocabulary
Instantiation	True
Used	EntityBiologicalObject, EntityBiologicalCompartment, Project
Properties	None.

✚ CellType

Used	Organism, Project
Properties	None.

✚ EvidenceCode

Used	Evidence, Project
Properties	None.

✚ ExperimentalFormType

Used	ExperimentalForm, Project
Properties	None.

✚ FeatureType

Used	SequenceFeature, Project
Properties	None.

✚ Tissue

Used	Organism, Project
Properties	None.

✚ Organism

Used	Complex, Dna, Rna, Protein, Model, SubModel, Project		
Properties	slot	range	mapping
	CELLTYPE	CellType{0,}	refCellTypeID
	TERM	string{0,1}	term
	TISSUE	Tissue{0,}	refTissueID
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref

SubClasses of SequenceLocation

✚ SequenceInterval

Used	SequenceFeature		
Properties	slot	range	mapping
	SEQUENCEINTERVAL BEGIN	SequenceIntervalBegin	<sequenceIntervalBegin/>
	SEQUENCEINTERVAL END	SequenceIntervalEnd	<sequenceIntervalEnd/>

✚ SequenceSite

Used	SequenceFeature		
Properties	slot	range	mapping
	SEQUENCEPOSITION	int{0,}	sequencePosition

	SEQUENCEPOSITIONSTATUS	(EQUAL LESS-THAN GRATER-THAN){0,1}	sequencePositionStatus
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SubClasses of SequenceSite

SequenceIntervalBegin

Used	SequenceInterval
Properties	None.

SequenceIntervalEnd

Used	SequenceInterval
Properties	None.

5 SubClasses of ChartBase

Chart

Used	Project		
Properties	slot	range	mapping
	CHARTID	string	chartID
	COMMENT	Comment{0,}	<comments/>
	NAME	string{0,1}	name
	PROPERTY	Property{0,}	<property/>
	REFCHARTELEMENT	RefChartElement{0,}	<refChartElement/>

RefChart

Used	View		
Properties	slot	range	mapping
	PROPERTY	Property{0,}	The properties that are overrided to the properties of the referenced chart.
	CHART	Chart	The class references to an instance of Chart.

RefChartElement

Instantiation	True		
Used	Chart		
Properties	slot	range	mapping
	ELEMENT	ElementBase	refID
	NAME	string{0,1}	name
	REFPROPERTY	string	refProperty

6 SubClasses of ElementBase

✚ Connector

Used	Process		
Properties	slot	range	mapping
	ANIMATIONPROPERTY	AnimationProperty{0,1}	<animationProperty>
	CONNECTORSIMULATIONPROPERTY	ConnectorSimulationProperty{0,1}	<connectorSimulationProperty>
	ENTITY	Entity	refID

✚ Entity

Used	ExperimentalForm, Connector, Complex, Model		
Properties	slot	range	mapping
	ANIMATIONPROPERTY	AnimationProperty{0,1}	<animationProperty>
	ENTITIESIMULATIONPROPERTY	EntitySimulationProperty	<entitySimulationProperty>

✚ Fact

Used	Model		
Properties	slot	range	mapping
	PARTICIPANTS	Element{0,}	<participant/>

✚ Process

Used	Model		
Properties	slot	range	mapping
	ANIMATIONPROPERTY	AnimationProperty{0,1}	<animationProperty>
	CONNECTORS	Connector{0,}	<connector/>
	PROCESSSIMULATIONPROPERTY	ProcessSimulationProperty{0,1}	<processSimulationProperty/>

SubClasses of Connector

✚ Input

Instantiation	False
Properties	None.

✚ Output

Instantiation	False
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Properties	None.
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SubClasses of Input

InputAssociation

Instantiation	False
Properties	None.

InputInhibitor

Instantiation	False
Properties	None.

InputProcess

Instantiation	False
Properties	None.

SubClasses of InputAssociation

InputAssociationBiological

Used	Process (The parent Connector class is referenced.)		
Properties	slot	range	mapping
	BIOLOGICALROLE	BiologicalRole{0,1}	<biologicalProperty refBiologicalRoleID=""/>

InputAssociationNonBiological

Instantiation	False
Properties	None.

SubClasses of InputAssociationNonBiological

InputAssociationNonBiologicalOther

Used	Process (The parent Connector class is referenced.)
Properties	None.

InputAssociationNonBiologicalPrimitive

Used	Process (The parent Connector class is referenced.)
Properties	None.

InputAssociationNonBiologicalUndef

Used	Process (The parent Connector class is referenced.)
Properties	None.

InputAssociationNonBiologicalUnknown

Used	Process (The parent Connector class is referenced.)
Properties	None.

SubClasses of InputInhibitor

InputInhibitorBiological

Instantiation	False		
Properties	slot	range	mapping
	BIOLOGICALROLE	BiologicalRole{0,1}	<biologicalProperty refBiologicalRoleID=""/>

InputInhibitorNonBiological

Instantiation	False
Properties	None.

SubClasses of InputInhibitorNonBiological

InputInhibitorNonBiologicalOther

Used	Process (The parent Connector class is referenced.)
Properties	None.

InputInhibitorNonBiologicalPrimitive

Used	Process (The parent Connector class is referenced.)
Properties	None.

InputInhibitorNonBiologicalUndef

Used	Process (The parent Connector class is referenced.)
Properties	None.

InputInhibitorNonBiologicalUnknown

Used	Process (The parent Connector class is referenced.)
Properties	None.

SubClasses of InputProcess

InputProcessBiological

Used	Process (The parent Connector class is referenced.)		
Properties	slot	range	description
	BIOLOGICALROLE	BiologicalRole{0,1}	<biologicalProperty refBiologicalRoleID=""/>

InputProcessNonBiological

Instantiation	False
Properties	None.

SubClasses of InputProcessNonBiological

InputProcessNonBiologicalOther

Used	Process (The parent Connector class is referenced.)
Properties	None

✚ InputProcessNonBiologicalPrimitive

Used	Process (The parent Connector class is referenced.)
Properties	None.

✚ InputProcessNonBiologicalUndef

Used	Process (The parent Connector class is referenced.)
Properties	None.

✚ InputProcessNonBiologicalUnknown

Used	Process (The parent Connector class is referenced.)
Properties	None.

SubClass of Output

✚ OutputProcess

Instantiation	False
Properties	None.

SubClasses of OutputProcess

✚ OutputProcessBiological

Used	Process (The parent Connector class is referenced.)		
Properties	slot	range	description
	BIOLOGICALROLE	BiologicalRole{0,1}	<biologicalProperty refBiologicalRoleID=""/>

✚ OutputProcessNonBiological

Instantiation	False
Properties	None.

SubClasses of NonBiological

✚ OutputProcessNonBiologicalOther

Used	Process (The parent Connector class is referenced.)
Properties	None.

✚ OutputProcessNonBiologicalPrimitive

Used	Process (The parent Connector class is referenced.)
Properties	None.

✚ OutputProcessNonBiologicalUndef

Used	Process (The parent Connector class is referenced.)
Properties	None

✚ OutputProcessNonBiologicalUnknown

Used	Process (The parent Connector class is referenced.)
Properties	None

SubClasses of Entity

EntityBiological

Instantiation	False		
Properties	slot	range	description
	SYNONYMS	string{0,}	<biologicalProperty synonyms=""/>
	BIOLOGICALROLE	BiologicalRole{0,}	<biologicalProperty refBiologicalRole=""/>
	DATASOURCE	DataSource{0,}	<biologicalProperty> <dataSource/> </biologicalProperty>
	SHORTNAME	string{0,1}	<biologicalProperty shortname=""/>
	AVAILABILITY	string{0,}	<biologicalProperty availability=""/>

EntityNonBiological

Instantiation	False
Properties	None.

SubClasses of EntityBiological

EntityBiologicalCompartment

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)		
Properties	slot	range	description
	CELLCOMPONENT	CellComponent	<biologicalProperty refCellComponentID=""/>

EntityBiologicalOther

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

EntityBiologicalUndef

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None.

EntityBiologicalUnknown

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

EntityBiologicalEnvironment

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

EntityBiologicalObject

Properties	slot	range	mapping
	CELLCOMPONENT	CellComponent	<biologicalProperty refCellComponent=""/>
	SEQUENCEFEATURE	SequenceFeature{0,}	<biologicalProperty> <sequenceFeature/> </biologicalProperty/>

SubClasses of Object

Cell

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)						
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>mapping</th> </tr> </thead> <tbody> <tr> <td>CELLTYPE</td> <td>CellType{0,}</td> <td><biologicalProperty refCellType=""/></td> </tr> </tbody> </table>	slot	range	mapping	CELLTYPE	CellType{0,}	<biologicalProperty refCellType=""/>
slot	range	mapping					
CELLTYPE	CellType{0,}	<biologicalProperty refCellType=""/>					

Complex

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)									
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>mapping</th> </tr> </thead> <tbody> <tr> <td>ENTITY</td> <td>Entity{0,}</td> <td>refID</td> </tr> <tr> <td>ORGANISM</td> <td>Organism{0,}</td> <td>refOrganismID</td> </tr> </tbody> </table>	slot	range	mapping	ENTITY	Entity{0,}	refID	ORGANISM	Organism{0,}	refOrganismID
slot	range	mapping								
ENTITY	Entity{0,}	refID								
ORGANISM	Organism{0,}	refOrganismID								

Dna

Definition	A Dna represents a DNA entity in a cell.						
Comment	The Dna class is similar to dna class in BioPAX except for COMPARTMENT slot takes in the parent Object class.						
Parent	EntityBiologicalObject						
Instantiation	true						
Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)						
Properties	<table border="1"> <thead> <tr> <th>slot</th> <th>range</th> <th>description</th> </tr> </thead> <tbody> <tr> <td>ORGANISM</td> <td>Organism{0,}</td> <td><biologicalProperty</td> </tr> </tbody> </table>	slot	range	description	ORGANISM	Organism{0,}	<biologicalProperty
slot	range	description					
ORGANISM	Organism{0,}	<biologicalProperty					

	SEQUENCE	string{0,1}	<biologicalProperty sequence=""/>
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✚ ObjectOther

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

✚ ObjectUndef

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

✚ ObjectUnknown

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

✚ Protein

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)		
Properties	slot	range	description
	SEQUENCE	string{0,1}	<biologicalProperty sequence=""/>
	ORGANISM	BioSource{0,}	<biologicalProperty refOrganism=""/>

✚ Rna

Instantiation	False		
Properties	slot	range	description
	ORGANISM	Organism{0,}	<biologicalProperty refOrganism=""/>
	Sequence	String{0,1}	<biologicalProperty sequence=""/>

✚ SmallMolecule

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)		
Properties	slot	range	mapping
	CHEMICALFORMULA	string{0,1}	<biologicalProperty

			chemicalFormula=""/>
	CHEMICALSTRUCTURE	ChemicalStructure{0,}	<biologicalProperty chemicalStructure=""/>
	MOLECULARWEIGHT	double{0,1}	<biologicalProperty molecularWeight=""/>

Subclasses of Rna

miRNA

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None.

mRNA

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

RnaOther

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

RnaUndef

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

RnaUnknown

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None

rRNA

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None.

tRNA

Used	ExperimentalForm, Connector, Complex, Model (The parent Entity class is referenced.)
Properties	None.

SubClasses of EntityNonBiological

EntityNonBiologicalOther

Used	Connector, Model (The parent Entity class is referenced.)
Properties	None.

EntityNonBiologicalPrimitive

Used	Connector, Model (The parent Entity class is referenced.)
Properties	None.

EntityNonBiologicalUndef

Used	Connector, Model (The parent Entity class is referenced.)
Properties	None.

EntityNonBiologicalUnknown

Used	Connector, Model (The parent Entity class is referenced.)
Properties	None.

SubClasses of Fact

FactView

Instantiation	False
Properties	None.

SimulationRestriction

Instantiation	False		
Properties	slot	range	mapping
	ANIMATIONPROPERTY	AnimationProperty{0,}	<animationProperty/>

FactBiological

Used	Model		
Properties	slot	range	description
	AVAILABILITY	string{0,}	<biologicalProperty availability=""/>
	BIOLOGICALEVENT	BiologicalEvent{0,}	<biologicalProperty biologicalEvent=""/>
	DELTA GPRIME O	DeltaGprimeO{0,}	<biologicalProperty> <deltaGprimeO/>

			</biologicalProperty>
	DELTAH	double{0,}	<biologicalProperty deltaH=""/>
	DELTAS	double{0,}	<biologicalProperty deltas=""/>
	ECNUMBER	string{0,}	<biologicalProperty encumber=""/>
	EVIDENCE	Evidence{0,}	<biologicalProperty> <evidence </biologicalProperty>
	KPRIME	float{0,}	<biologicalProperty kPrime=""/>
	SHORTNAME	string{0,}	<biologicalProperty shortName=""/>
	SYNONYMS	string{0,}	<biologicalProperty synonyms=""/>

FactOther

Used	Model
Properties	None.

SubClasses of FactView

FactViewElement

Used	Model
Properties	None.

FactViewGroup

Used	Model
Properties	None.

FactViewOther

Used	Model
Properties	None.

SubClasses of SimulationRestriction

AlgebraicRule

Used	Model
Properties	None.

FirstOrderLogic

Instantiation	true
Used	Model
Properties	None.

✚ SimulationRestrictionOther

Used	Model
Properties	None.

✚ TemporalLogic

Used	Model
Properties	None.

SubClasses of Process

✚ ProcessBiological

Properties	slot	range	description
	AVAILABILITY	string{0,}	<biologicalProperty availability=""/>
	BIOLOGICALEVENT	BiologicalEvent{0,}	<biologicalProperty biologicalEvent=""/>
	DELTAGPRIMEO	DeltaGprimeO{0,}	<biologicalProperty deltaGPrimeO=""/>
	DELTAH	double{0,}	<biologicalProperty deltaH=""/>
	DELTAS	double{0,}	<biologicalProperty deltaS=""/>
	ECNUMBER	string{0,}	<biologicalProperty ecNumber=""/>
	EVIDENCE	Evidence{0,}	<biologicalProperty> <evidence/> </biologicalProperty>
	KPRIME	float{0,}	<biologicalProperty kPrime=""/>
	SHORTNAME	string{0,}	<biologicalProperty shortName=""/>
	SYNONYMS	string{0,}	<biologicalProperty shortName=""/>

✚ ProcessNonBiological

Instantiation	False
Properties	None.

✚ ProcessNonBiological

Instantiation	False
Properties	None.

SubClasses of ProcessNonBiological

✚ ProcessNonBiologicalOther

Used	Model (The parent class Process is referenced.)
Properties	None.

✚ ProcessNonBiologicalPrimitive

Used	Model (The parent class Process is referenced.)
Properties	None.

✚ ProcessNonBiologicalUndef

Used	Model (The parent class Process is referenced.)
Properties	None.

✚ ProcessNonBiologicalUnknown

Used	Model (The parent class Process is referenced.)
Properties	None.

7 SubClasses of ExternalReferenceBase

✚ DataSource

Instantiation	False		
Properties	slot	range	mapping
	NAME	string{0,}	name
	PUBLICATIONXREF	PublicationXref{0,}	refPublicationXref
	UNIFICATIONXREF	UnificationXref{0,}	refUnificationXref
	RELATIONSHIPXREF	RelationshipXref{0,}	refRelationshipXref

✚ Xref

Instantiation	False		
Properties	slot	range	description
	DB	string{0,1}	db
	DBVERSION	string{0,1}	dbVersion
	NAME	string{0,}	name
	XLINKHREF	string{0,}	xlink:href
	XLINKTITLE	string{0,}	xlink:title
	XREFID	string{0,1}	xrefID
	XREFIDVERSION	string{0,1}	xrefIDVersion

SubClasses of Xref

✚ PublicationXref

Used	Confidence, Evidence, DataSource, SequenceFeature, ElementBase, Model, SubModel
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Properties	slot	range	mapping
	AUTHOR	string{0,}	author
	SOURCE	string{0,}	source
	TITLE	string{0,1}	title
	YEAR	string{0,1}	year

RelationshipXref

Used	Evidence, SequenceFeature, ElementBase, Model, SubModel		
Properties	slot	range	mapping
	RELATIONSHIPTYPE	string{0,}	relationshipType

UnificationXref

Used	Evidence, DataSource, SequenceFeature, ElementBase, OpenControlledVocabulary, Model, SubModel
Properties	None

8 SubClasses of LogBase

LogData

Used	LogDataList		
Properties	slot	range	description
	LOGVALUE	LogValue{0,}	Logged values for elements at a specific time point.
	TIMEPOINTS	long{0,}	The specific time point of logged data.

LogDataList

Definition	A Logged data of a simulation result.		
Comment			
Parent	LogBase		
Used	LoggedProperty		
Properties	slot	range	mapping
	LOGDATA	LogData{0,}	<logData>
	LOGSTEPS	int{0,}	logSteps

LoggedProperty

Definition	A LoggedProperty specifies a logged property of model or submodel.		
Comment			
Parent	LogBase		
Used	Model, SubModel		

Properties	slot	range	description
	LOGDATALIST	LogDataList	<logDataList>
	PROPERTY	Property{0,}	<property>
	REFLOGELEMENT	RefLogElement{0,}	<refLogElement>

LogValue

Used	LogData		
Properties	slot	range	mapping
	REFLOGID	int	refLogID
	VALUE	string	value

RefLogElement

Used	LoggedProperty		
Properties	slot	range	mapping
	LOGID	int	logID
	REFID	string	refID
	REFPROPERTY	string	refProperty

9 SubClasses of MapBase

EntityMap

Used	ImportModel		
Properties	slot	range	mapping
	FROMELEMENT	Entity(override)	fromRefID
	TOELEMENT	Entity(override)	toRefID

FactMap

Used	ImportModel		
Properties	slot	range	description
	FROMELEMENT	Fact(override)	fromRefID
	TOELEMENT	Fact(override)	toRefID

ProcessMap

Used	ImportModel		
Properties	slot	range	description
	FROMELEMENT	Process(override)	fromRefID
	TOELEMENT	Process(override)	toRefID

10 SubClasses of SimulationBase

Function

Used	GlobalSimulationProperty		
Properties	slot	range	mapping
	SCRIPT	Script	<script>

Script

Used	ConnectorFiring, Variable, Delay, Firing, Function		
Properties	slot	range	mapping
	CONTENTS	string	CONTENTS
	KEY	string	key
	LANGUAGE	string	language

UnitBase

Instantiation	False
Properties	None.

Variable

Used	EntitySimulationProperty, ConnectorSimulationProperty, ProcessSimulationProperty		
Properties	slot	range	mapping
	PARAMETER	Parameter{0,}	parameter
	SCRIPT	Script{0,}	<script>
	TYPE	string	type
	VARIABLEID	string	variableID

ConnectorFiring

Used	ConnectorSimulationProperty		
Properties	slot	range	mapping
	CONNECTORFIRINGSTYLE	string	connectorFiringStyle
	SCRIPT	Script{0,}	<script>
	VALUE	string{0,}	value

ConnectorKinetic

Used	ConnectorSimulationProperty		
Properties	slot	range	mapping
	PARAMETER	Parameters{0,}	<parameter>

✚ ConnectorSimulationProperty

Used	Connector		
Properties	slot	range	mapping
	CONNECTORFIRING	ConnectorFiring{0,1}	<connectorFiring>
	CONNECTORKINETIC	Kinetic{0,1}	<connectorKinetic>
	VARIABLE	Variable{0,}	<variable>

✚ Delay

Used	ProcessSimulationProperty		
Properties	slot	range	mapping
	DELAYSTYLE	string{0,1}	delayStyle
	SCRIPT	Script{0,1}	<script>
	VALUE	string{0,1}	value

✚ EntitySimulationProperty

Used	Entity		
Properties	slot	range	mapping
	VARIABLE	Variable{0,}	<variable>

✚ Firing

Used	ProcessSimulationProperty		
Properties	slot	range	mapping
	FIRINGONCE	Boolean{0,1}	firingOnce
	FIRINGSTYLE	string{0,1}	firingStyle
	RULEVALUE	string{0,1}	ruleValue
	SCRIPT	Script{0,1}	<script>
	TYPE	string{0,1}	type
	VALUE	string{0,1}	value

✚ GlobalSimulationProperty

Used	Project		
Properties	slot	range	mapping
	FUNCTION	Function{0,}	<functionSet> <function/>* </functionSet>
	NEWUNIT	NewUnit{0,}	<unitSet> <newUnit/>* </unitSet>

✚ ProcessKinetic

Used	ProcessSimulationProperty		
Properties	slot	range	mapping
	CALCSTYLE	string{0,1}	calcStyle
	FAST	Boolean{0,1}	fast
	KINETICSTYLE	string{0,1}	kineticStyle
	PARAMETER	Parameters{0,}	<parameter>

✚ ModelSimulationProperty

Used	Model, SubModel		
Properties	slot	range	mapping
	PARAMETER	Parameter{0,}	<parameter>

✚ Priority

Used	ProcessSimulationProperty		
Properties	slot	range	mapping
	PRIORITYVALUE	int	value

✚ ProcessSimulationProperty

Used	Process		
Properties	slot	range	mapping
	DELAY	Delay{0,1}	<delay>
	FIRING	Firing{0,1}	<firing>
	PROCESSKINETIC	Kinetic{0,1}	<processKinetic>
	PRIORITY	Priority{0,1}	<priority>
VARIABLE	Variable{0,}	<variable>	

SubClasses of UnitBase

✚ NewUnit

Used	GlobalSimulationProperty		
Properties	slot	range	mapping
	BASEUNITS	Boolean{0,1}	baseUnits
	NAME	string	name
	SYMBOL	string	symbol
UNIT	Unit{0,}	unit	

✚ Unit

Used	NewUnit
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Properties	slot	range	mapping
	EXPONENT	double{0,1}	exponent
	MULTIPLIER	double{0,1}	multiplier
	OFFSET	double{0,1}	offset
	PREFIX	string{0,1}	prefix
	UNITS	string{0,}	units

11 SubClasses of ViewBase

Cache

Used	GlobalShape, Shape		
Properties	slot	range	mapping
	HEIGHT	double	height
	WIDTH	double	width
	XLINKHREF	string	xlink:href

GlobalShape

Used	GlobalViewProperty		
Properties	slot	range	mapping
	CACHE	Cache{0,1}	<cache>
	COMMENT	Comment{0,}	<comments> <comment/> </comments>
	FILTER	Filter{0,}	<filter>
	NAME	string{0,1}	name
	SELECTION	Selection{0,}	<selection>
	SHAPEID	string{0,}	shapeID
	SVG	string{0,}	<svg:svg>


Layout

Used	View		
Properties	slot	range	mapping
	CSMLLAYOUT	string	<csml-layout:layout>

Position

Used	RefElement		
Properties	slot	range	mapping
	POSITIONID	string{0,}	positionID

	POSITIONSTATUS	(auto static){0,1}	positionStatus
	X	double{0,}	x
	Y	double{0,}	y

 Shape

Used	ViewProperty		
Properties	slot	range	mapping
	DEPTH	int{0,1}	depth
	SHAPEID	string{0,}	shapeID
	SVG	string{0,1}	<svg:svg>
	CACHE	Cache{0,1}	<cache>

 RefElement

Used	View		
Properties	slot	range	mapping
	ANIMATION	Animation{0,1}	<animation>
	ELEMENT	ElementBase	refID
	INCLUDECHILD	boolean{0,1}	includeChild
	POSITION	Positon{0,1}	position

 View

Used	Project		
Properties	slot	range	mapping
	COMMENT	Comment{0,}	<comments> <comment/> </comments>
	LAYOUT	Layout{0,1}	<layout>
	MODELID	string{0,1}	modelID
	NAME	string{0,1}	name
	REFANIMATIONID	string{0,}	refAnimationID
	REFCHART	RefChart{0,}	<refChart>
	REFCHARTID	string{0,}	refChartID
	REFELEMENT	RefElement{0,}	<refElement>
	REFPOSITIONID	string{0,}	refPositionID
	REFSHAPEID	string{0,}	refShapeID
	VIEWID	string	viewID

✚ GlobalViewProperty

Used	Project		
Properties	slot	range	mapping
	GLOBALSHAPE	GlobalShape{0,}	<globalShape>

✚ ViewProperty

Used	ElementBase, ImportModel		
Properties	slot	range	mapping
	POSITION	Position{0,}	<position>
	SHAPE	Shape{0,}	<shape>