SBGN PD

Current status, future changes and unresolved issues

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PD Specification

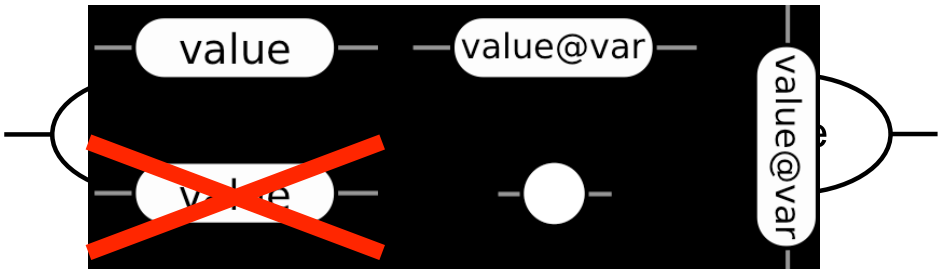
- Level 1 Version 1: Sep 2008
  - Original specification
- Level 1 Version 1.1: Sep 2009
  - Fixed inconsistencies
  - Typos
  - Clarified “ontology” of glyphs
  - Nomenclature changes for consistency with other languages
- Level 1 Version 1.2: Oct 2010
- Level 1 Version 1.3: Feb 2011
  - Minor changes of clarity
  - Document errors
- Level 1 Version 2.0 Q2 2013

What's in Version 2.0

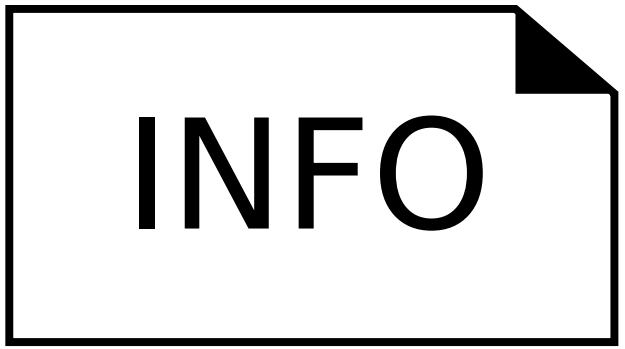
- New/Modified Glyphs
- Resolving semantic "issues"
- Enumerated rules
- Improve organisation/clarity of the spec

Resolved Issues

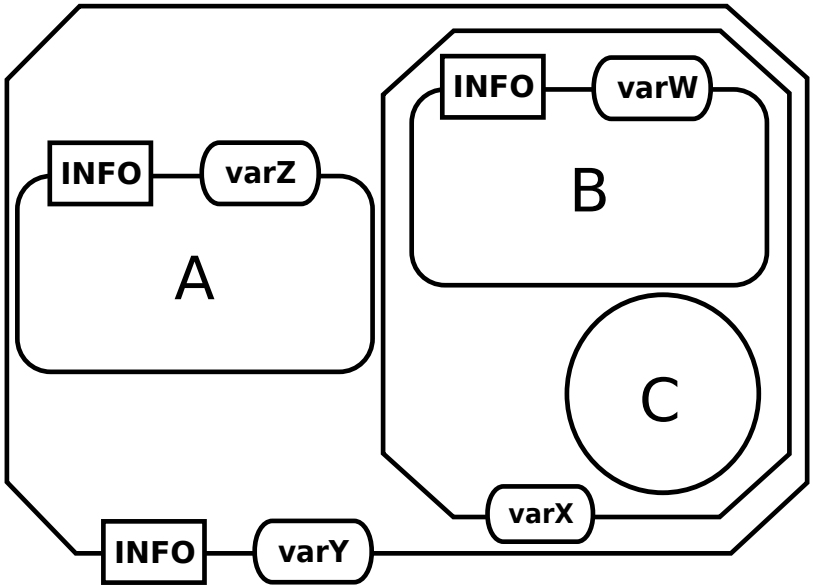
State Glyph Change



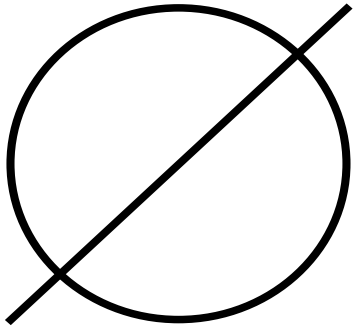
New Annotation Glyph

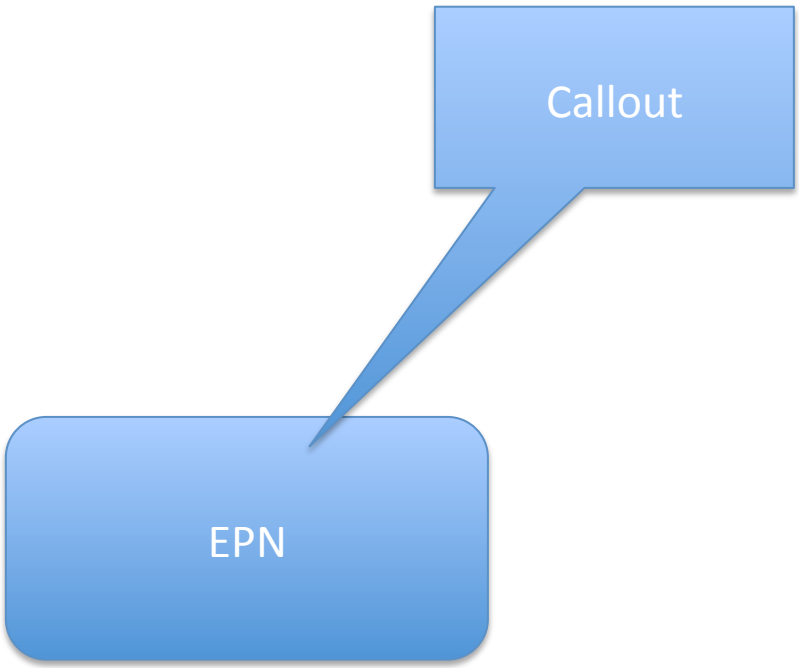


Complex Subunits are Decorators



Empty Set

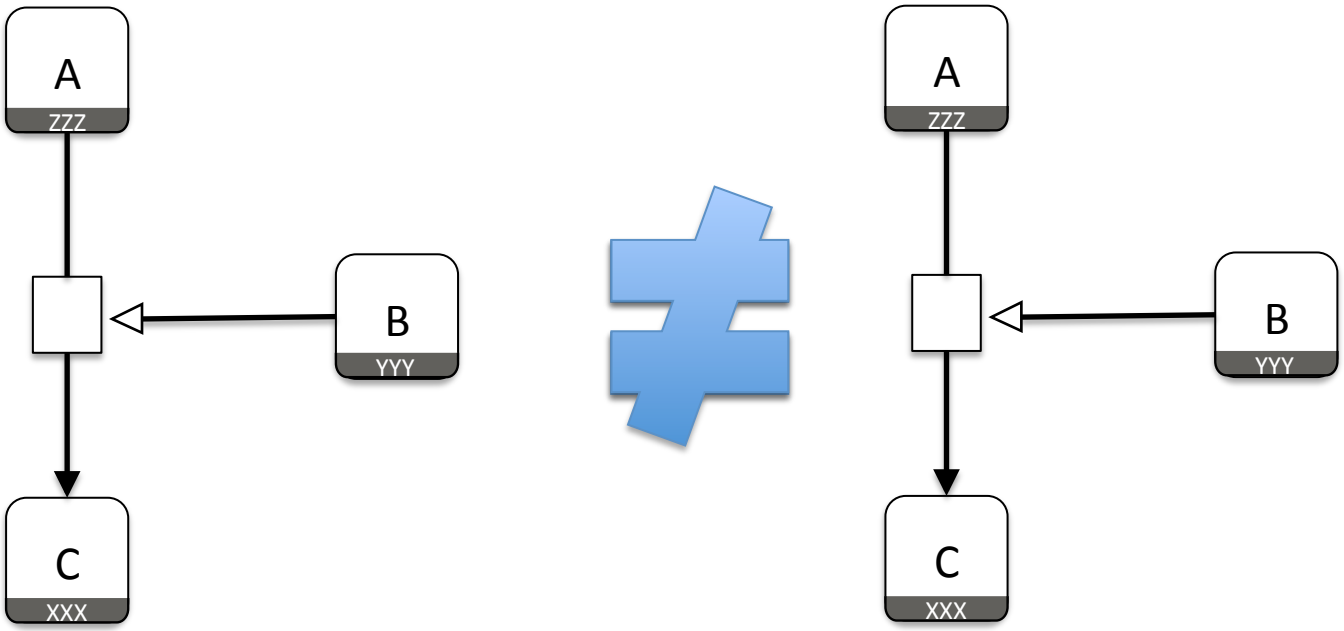



Callout
EPN

Simple Chemical

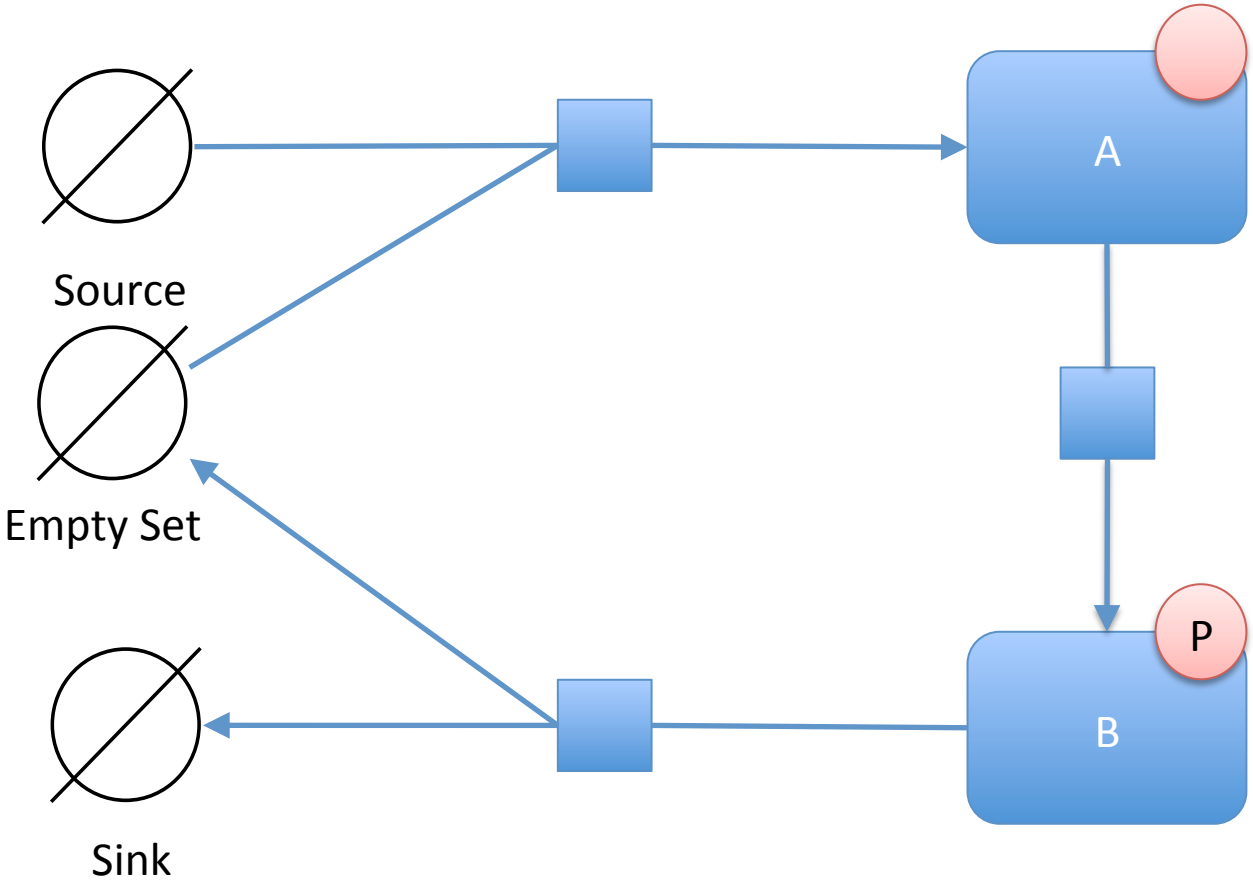
Level 1 Version 2.0: Semantics

Process Duplication

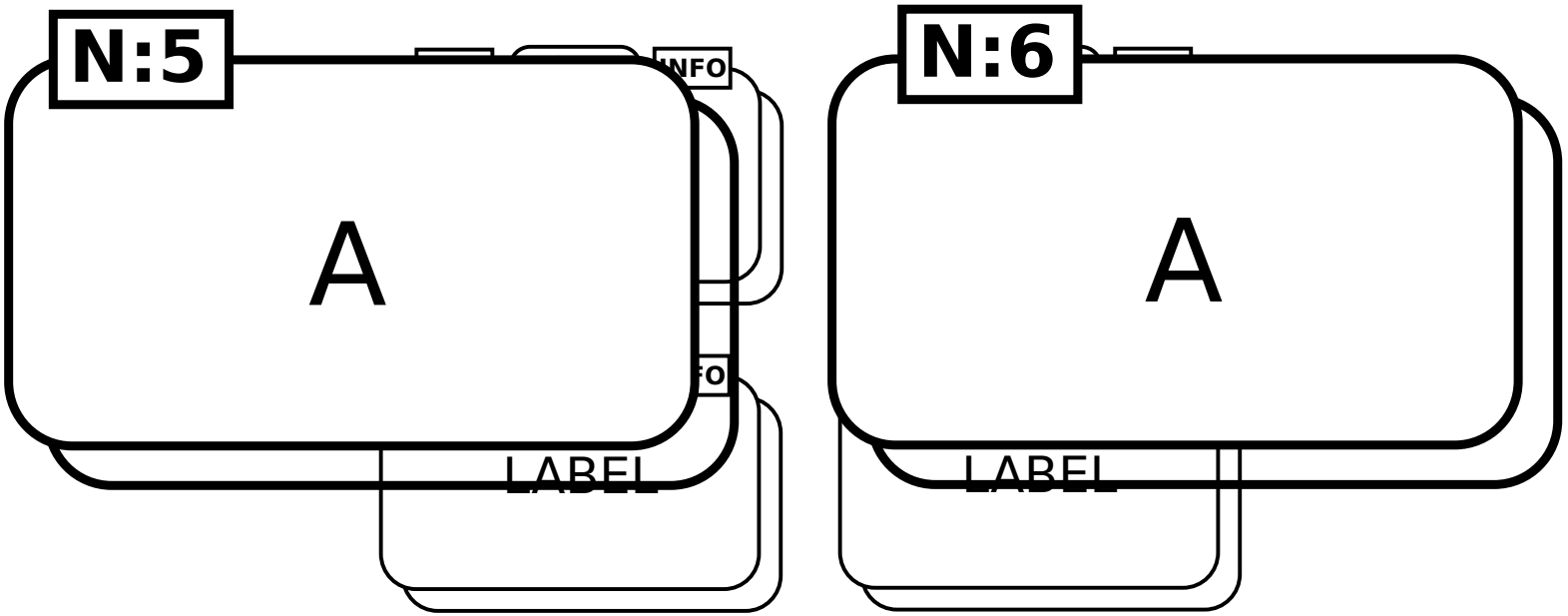


Level 1 Version 2.0: Semantics

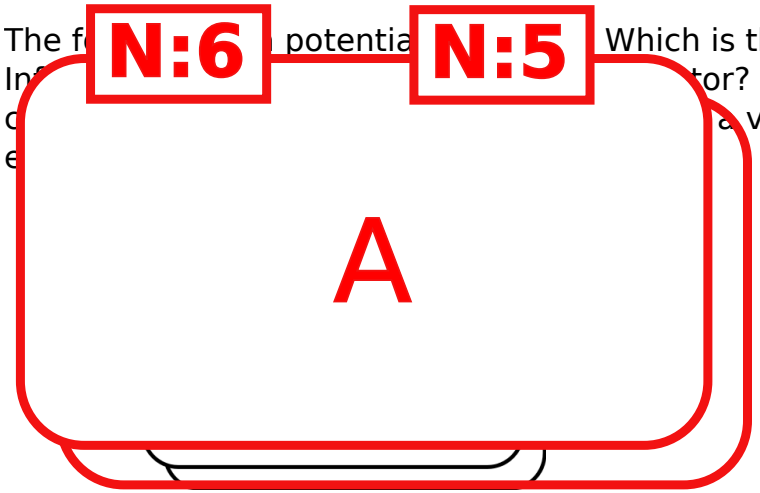
Source and Sink => Empty Set



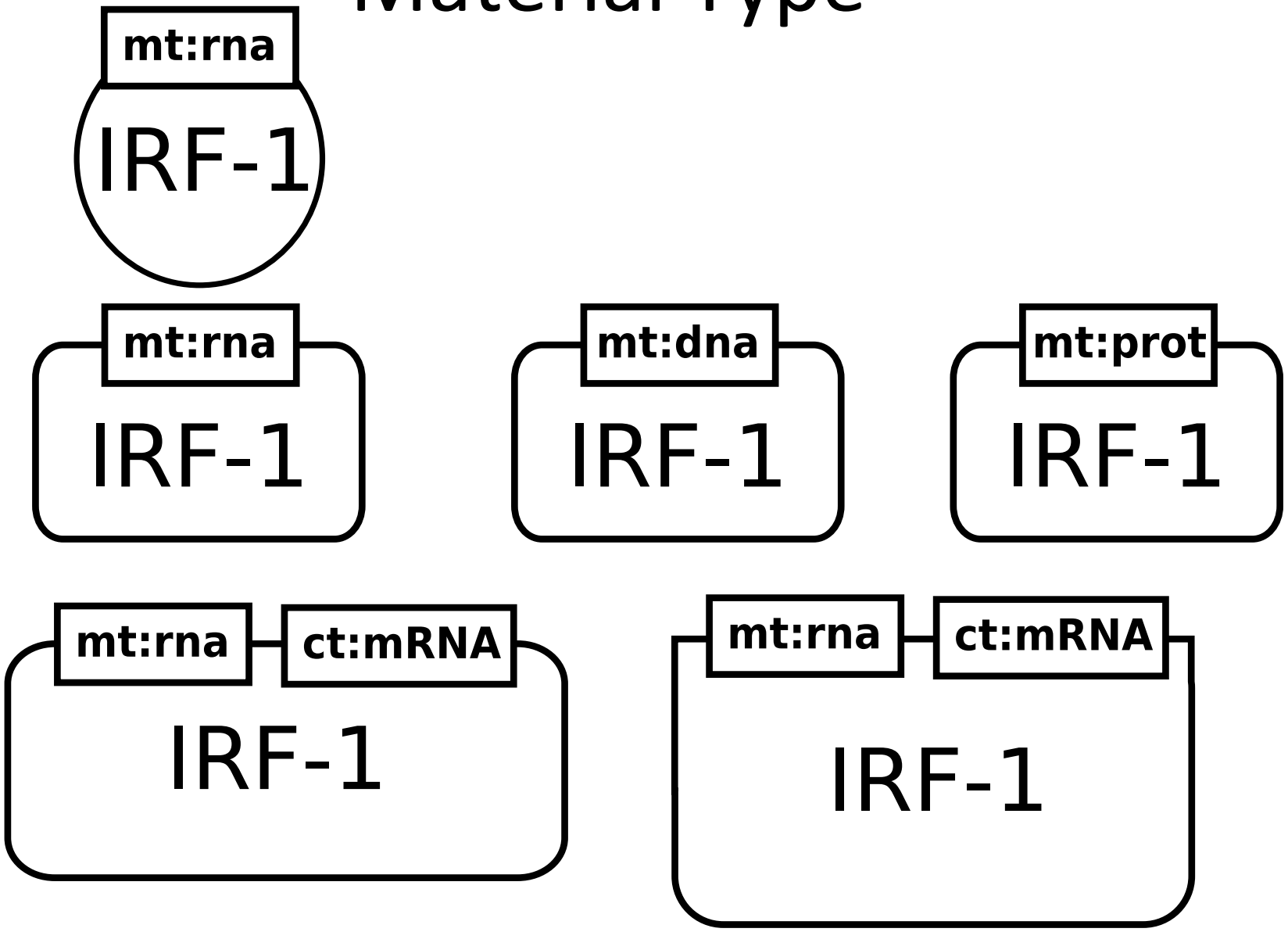
Cardinality Glyph



The f potentia Which is the Unit of
In tor? Or are both
c a validation
e



Material Type



Level 1 Version 2.0: Spec

- Major rewrite
  - Based on SBML spec
  - Based on UML spec

- Aim
  - Remove ambiguities that exist in current spec
  - Remove grey areas

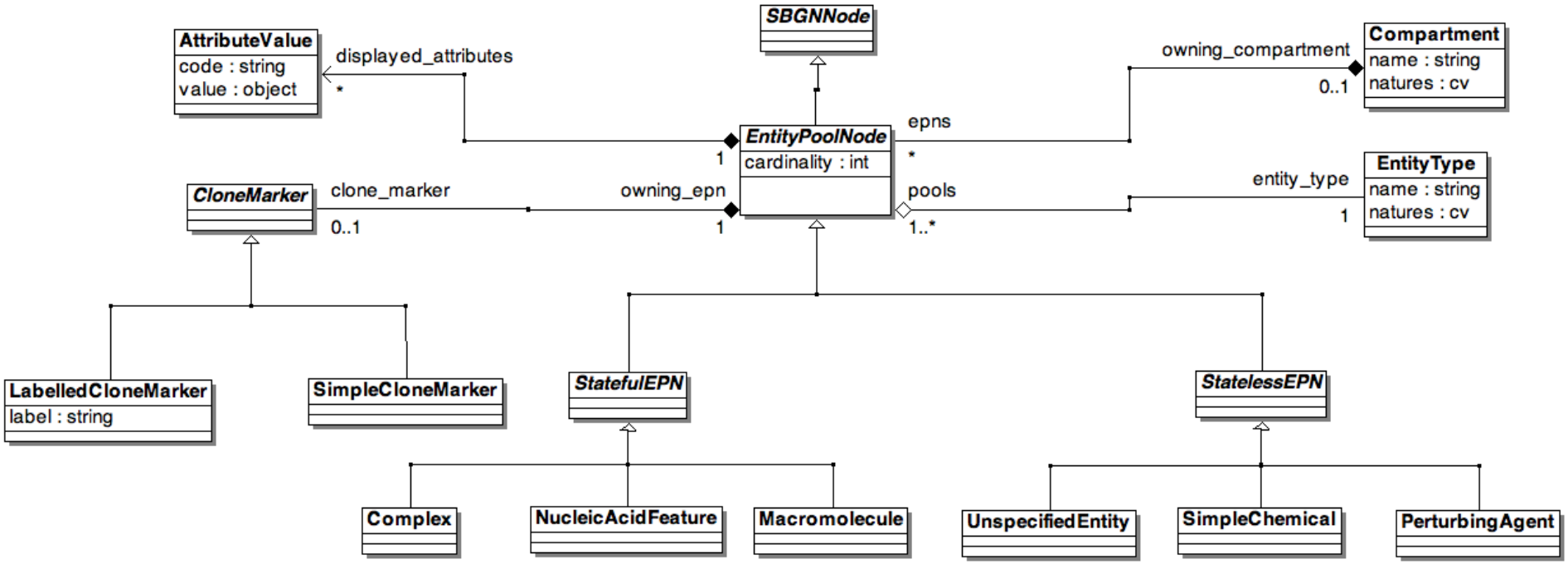
Contents

Rule and Constraints

None.

Changes from Previous Version

Although not defined explicitly in the previous version, arguably this concept did exist in the language.



therefore distinguished from other pools with the same entity type by its cardinality, its owning_compartment and the values of its StateVariables (where appropriate). It must belong to a compartment or be associated with the map (c.f. section 5.5) and can contain a clone marker if it is cloned (see section 5.7)— note that not all EPNs can be cloned.

Generalisation

- SBGNNode (see section 5.5)

[10] Although this concept is discussed it is not explicitly defined previously.

Attributes

cardinality: int **(R)** The number of copies of the entity. Must be a positive non-zero integer.

Associations

owning_compartment:Compartment (0..1) The compartment that this EPN belongs too.

section 5.5) (degree > 0).

- All StateVariableDefinitions associated with the EntityType must have an associated StateVariable.

[11] This is an alternate way of using the Unit of Information to display information, but to constrain it so that it presents attributes of the EPN not general annotation. See the AttributeValue class for more information.

Rules and Constraints

- State variables do not need to be logically unique, therefore two or more state variables with the same name are permitted.

StatefulEPN

StatefulEntityPoolNode undergo physical changes, for example chemical modification or conformational change, which we wish to record in a Process Description map. This information is captured via the StateVariable (as can be seen in figure 5.16). The LabelledCloneMarker must be used to indicated that the StatefulEPN is cloned.

Changes from Previous Version

No defined explicitly in the previous version.

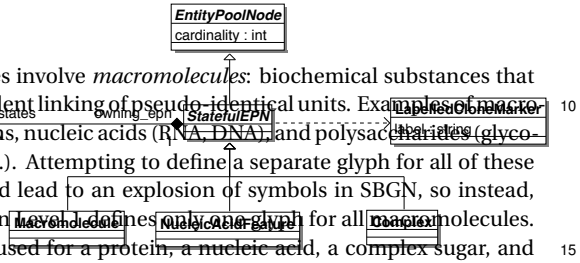


Figure 5.16: UML definition of the stateful entity pool node: showing its descendants and its association with state variables.

Generalisation

- StatefulEPN (see section 5.5)

Generalisation

Attributes

- EntityPoolNode (see section 5.5)

No additional attributes.

Attributes

Associations

No additional attributes.

No additional associations.

Rules and Constraints

Associations

No additional constraints.

- states:StateVariable (*) The state variables that belong to this class.

Notation

There are two glyphs associated with Macromolecule. The first *Macromolecule monomer* is used when cardinality = 1 and the second *Macromolecule multimer* is used when cardinality > 1.

Glyph: ***Macromolecule monomer***

SBO Term: SBO:0000245 ! macromolecule

Container: A macromolecule is represented by a rectangular container with rounded corners, as illustrated in Figure 5.17.

Label: A *macromolecule* is identified by a label placed in an unbordered box containing a string of characters. The characters can be distributed on several lines to improve readability, although this is not mandatory. The label box must be attached to the center of the container. The label may spill outside of the container.

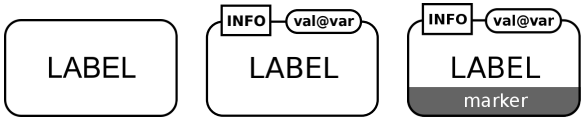


Figure 5.17: The Process Description glyph for *macromolecule*, shown plain and unadorned on the left, and with an additional state variable and a unit of information in the middle and the cloned form on the right.

Glyph: ***Macromolecule multimer***

SBO Term: SBO:0000420 ! multimer of macromolecules

Container: A *multimer* is represented by two identical containers shifted horizontally and vertically and stacked one on top of the other. Figure 5.18 illustrates the glyph.

Label: As monomer

Figure 5.18: The Process Description glyph for *macromolecule multimer*, shown plain and unadorned on the left, and with an additional state variable and a unit of information in the right and the cloned form on the right.

Usage Examples In this section, we provide examples of Entity Pool Node representations drawn using the SBGN Process Description Level 1 glyphs described above.

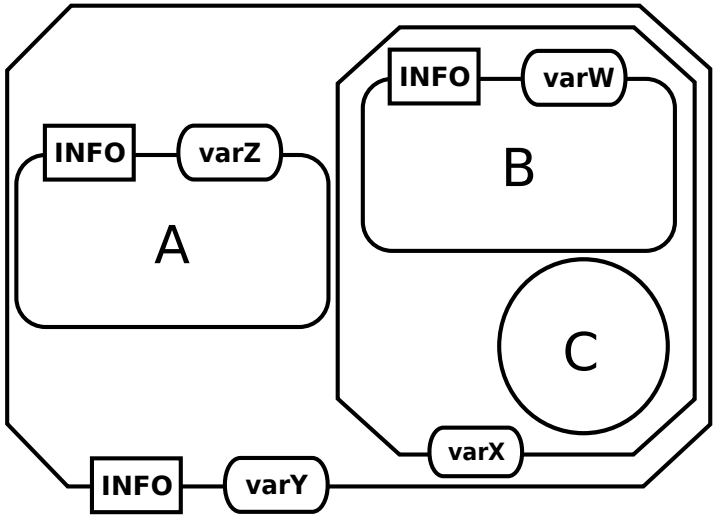
Figure 5.19 represents calcium/calmodulin kinase II, with phosphorylation on the sites threonine 286 and 306, as well as catalytic and autoinhibitory domains. Note the use of *units of information* and *state variables*.

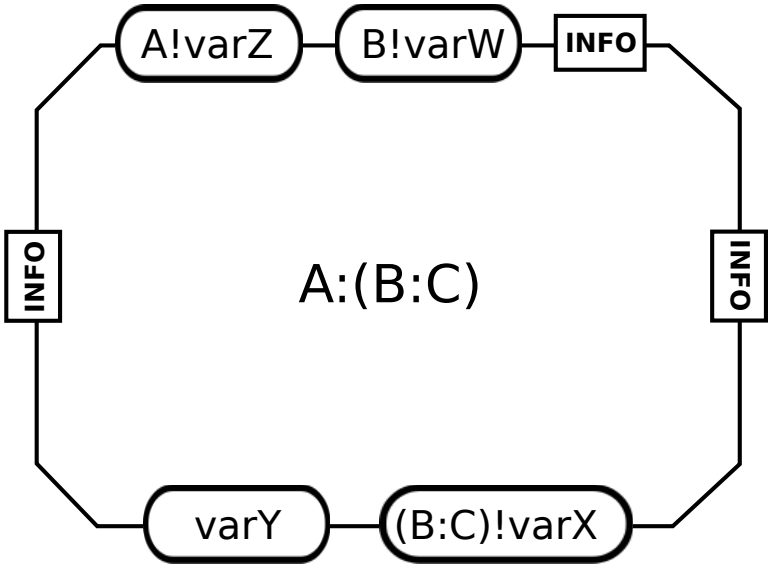
Worked Examples: Help

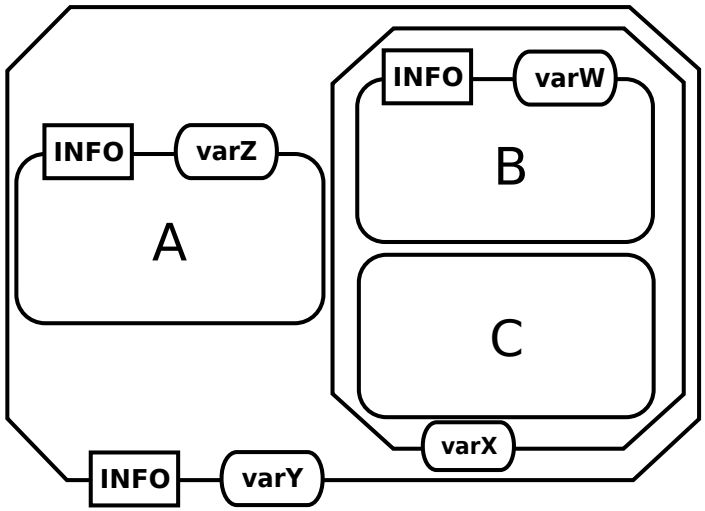
- Metabolism
- Signalling – states, complexes, multimers
- Compartments, pertubation and phenotypes
- Gene regulation. Poss transport between compartments
- Submap usage

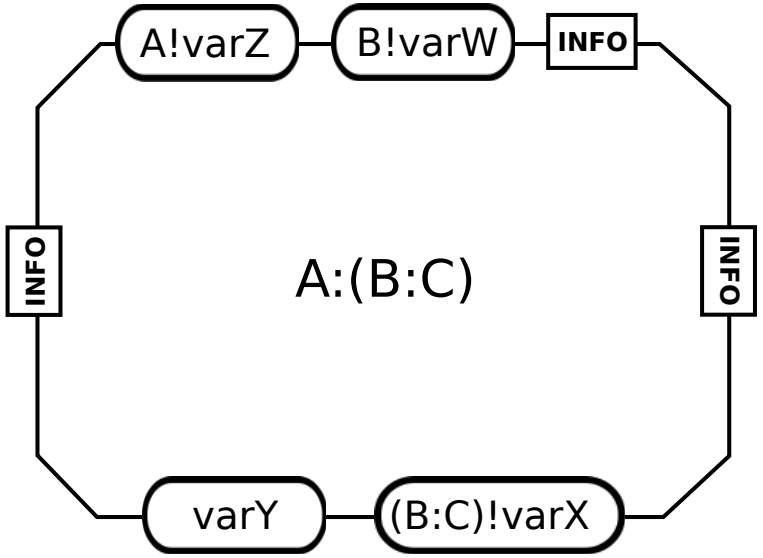
Unresolved Issues

Complex Identity

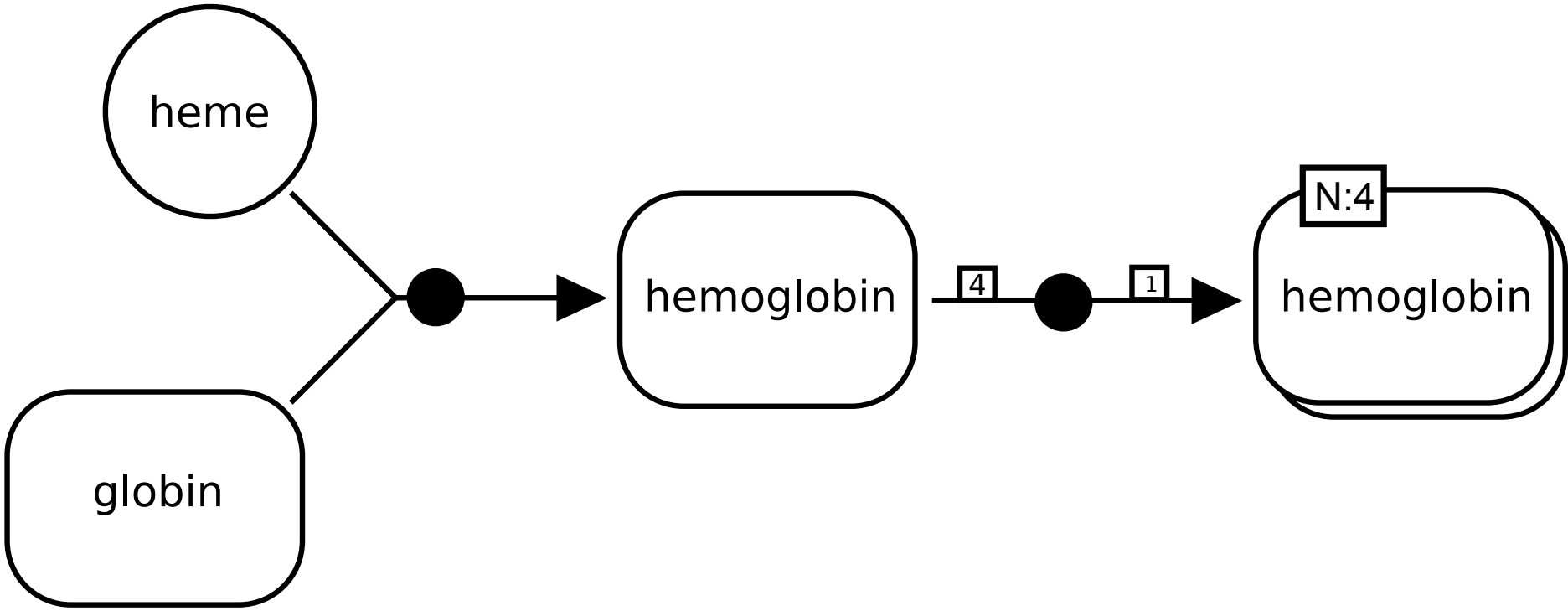


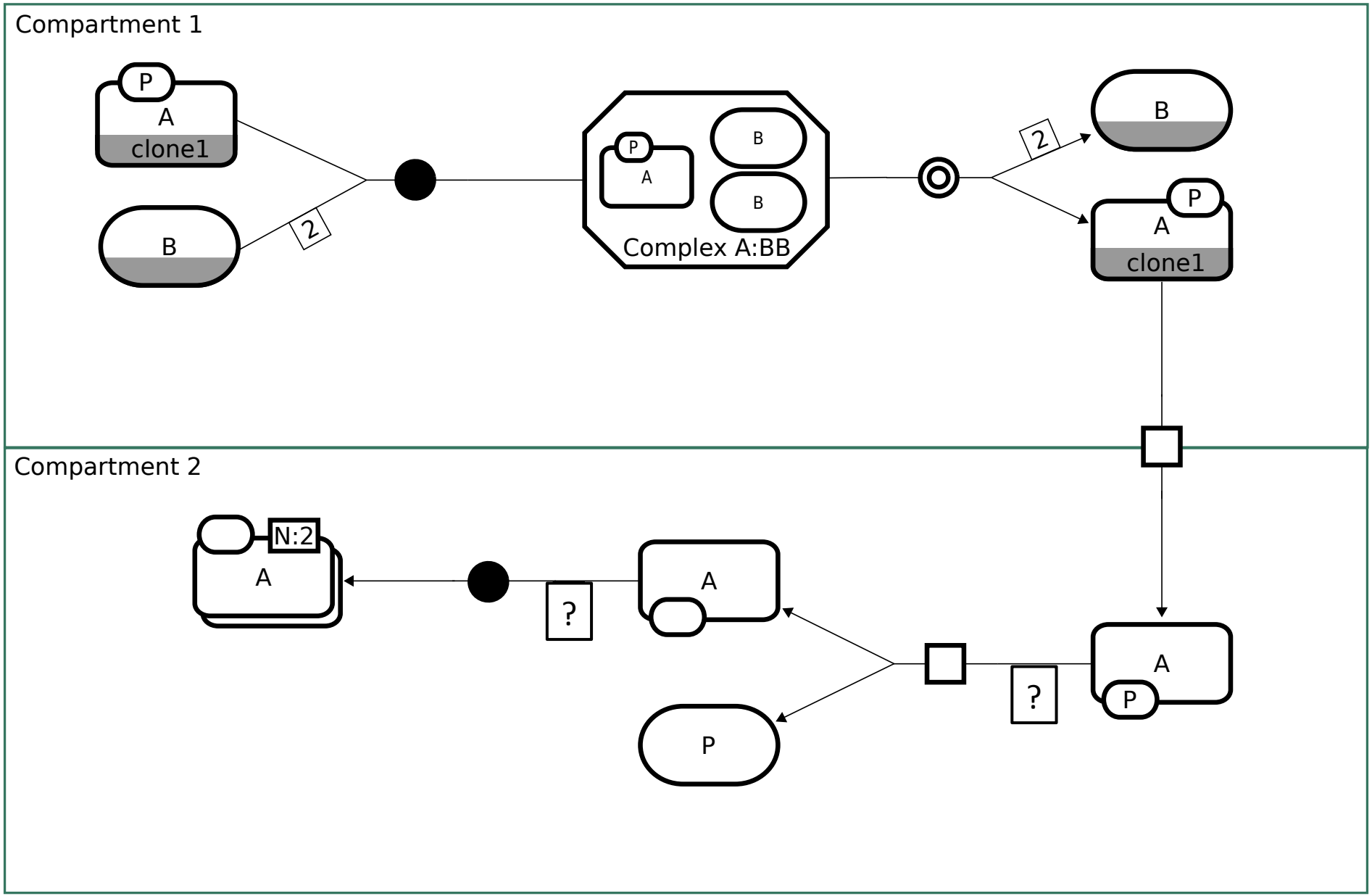


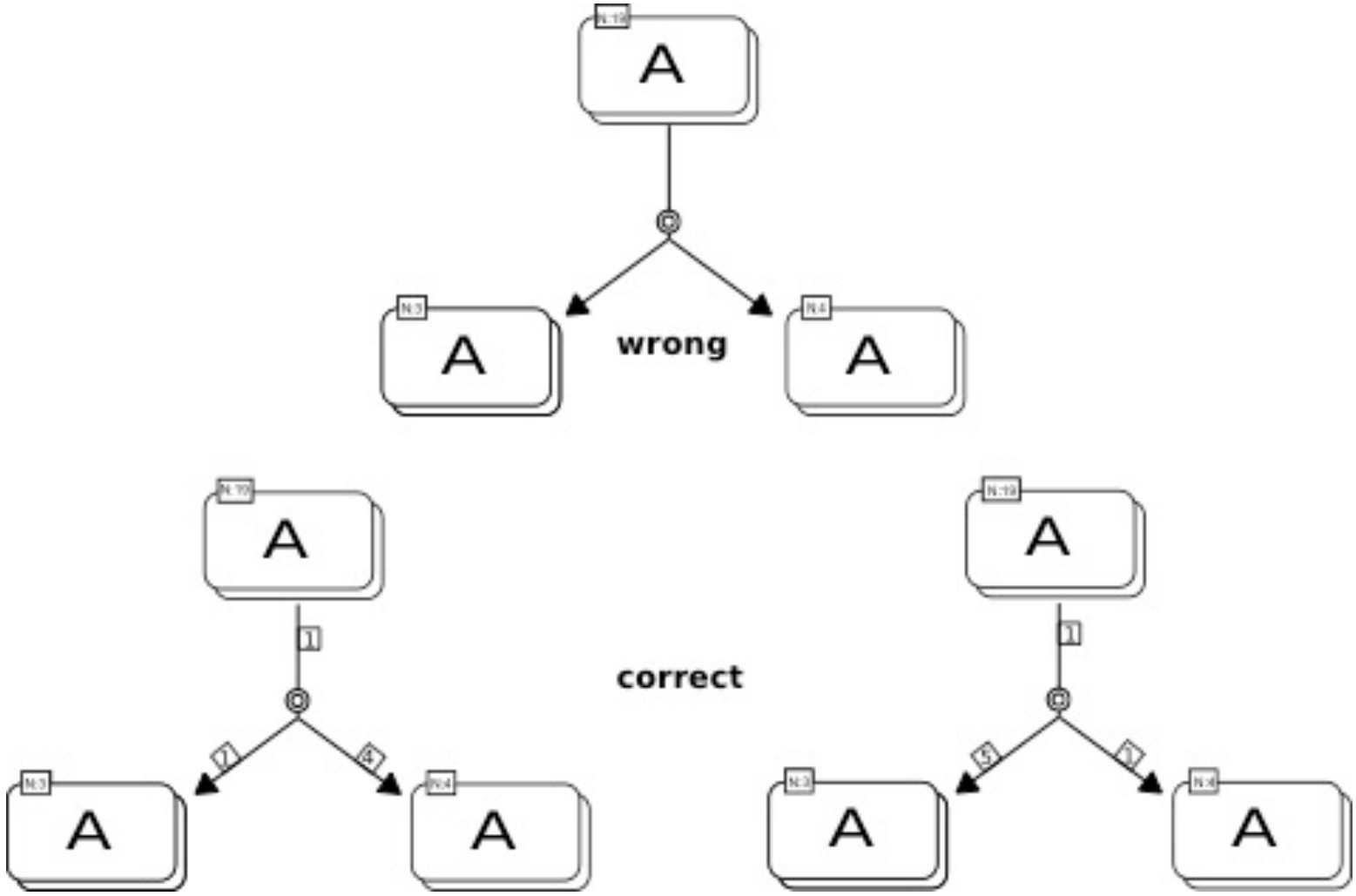




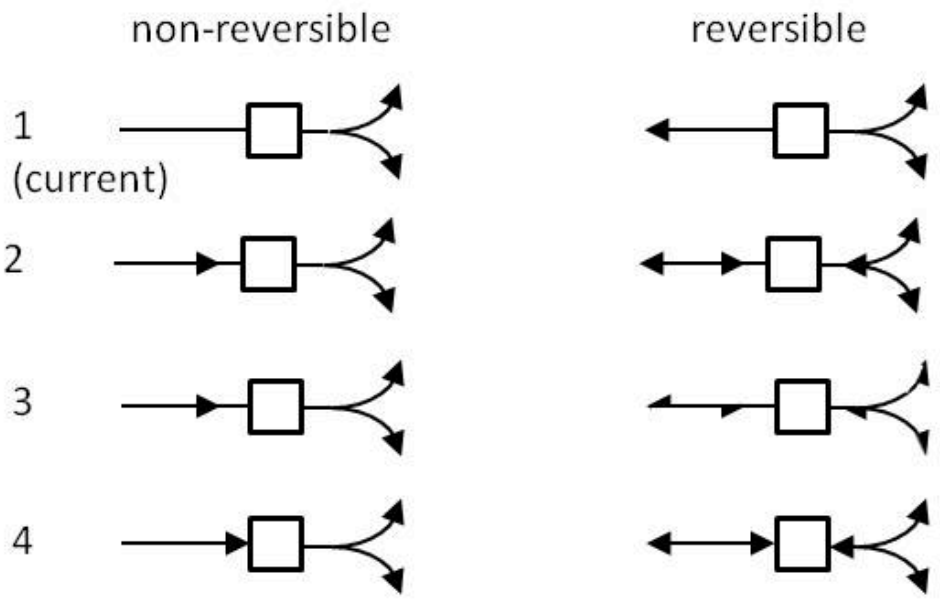
Stoichiometry



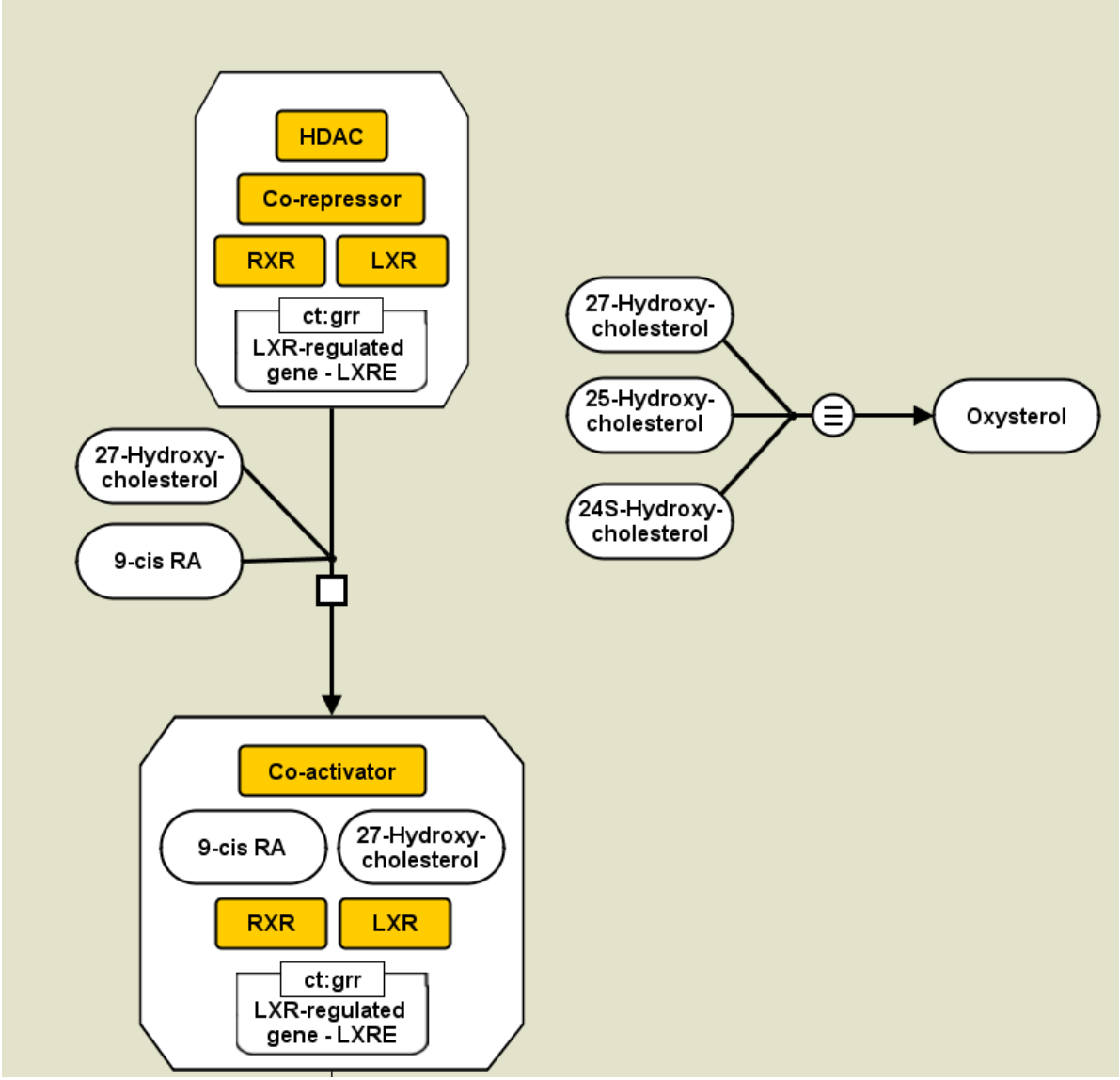

Compartment 1
P
A
clone1
B
2
P
A
B
B
Complex A:BB
2
B
P
A
clone1
Compartment 2
N:2
A
?
A
?
A
P
P


A
A
A
wrong
A
A
A
correct
A
A
A

For Discussion: Reversible Arcs



Generics


HDAC
Co-repressor
RXR
LXR
ct:grr
LXR-regulated gene - LXRE
27-Hydroxy-cholesterol
9-cis RA
27-Hydroxy-cholesterol
25-Hydroxy-cholesterol
24S-Hydroxy-cholesterol
Oxysterol
Co-activator
9-cis RA
27-Hydroxy-cholesterol
RXR
LXR
ct:grr
LXR-regulated gene - LXRE

Generics: outcomes

- New glyph?
- Looks like it works
- Experimental proposal?
- Tool support?

Road Map for PD

- Level 1 Version 2.0
  - Draft for Review: Q2 2013
  - RFC: 2-3 Weeks
  - Release Q3 2013

Acknowledgements

- SBGN Editors
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  - Nicolas Le Novère
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  - Emek Demir
- SBGN Community