4. General layout of SBGN diagrams

4.1. Introduction

This section provides rules for the layout of process diagrams, that is the arrangement of its objects. Objects are state/entity and transition/relationship nodes, containers (modules, compartments), and arcs connecting these nodes/containers. The layout guidelines consist of two parts: 1. *requirements*, i.e. rules which have to be fulfilled by a layout, and 2. *recommendations*, i.e. rules which should be followed if possible. In the appendix there is a list of *additional suggestions* which may help in producing aesthetically more pleasant layouts which may be easier to understand.

The layout guidelines are independent of the way the diagram is produced and apply to both, manually drawn diagrams as well as diagrams produced by a layout algorithm. The guidelines do not deal with interaction aspects (e.g. the effect of zooming) but apply to diagrams in standard view.

4.2. Layout guidelines

4.2.1 Requirements

4.2.1.1 Node-node overlaps

Nodes are not allowed to overlap apart from nodes overlapping compartments (e.g. a complex placed on the compartment border). This includes touching of nodes. Touching is not allowed apart from the case where it has a specific meaning, e.g. two macromolecules touching each other within a complex because they are forming the complex.
Compartment borders are not allowed to overlap and are only allowed to touch each other if this is meaningful, e.g. ER and ER membrane. Modules are not allowed to overlap. Compartments and modules can contain other nodes including compartments and/or modules.

(Fig. 1)

4.2.1.2 Node-edge overlaps

In case of edge-node crossing the edge must be drawn on the top of the node. See also recommendation 4.2.1.1 (crossing between edges and nodes should be avoided).

(Fig. 2)

4.2.1.3 Node border-edge overlaps

Edges are not allowed to overlap the border lines of nodes.

(Fig. 3)

4.2.1.4 Edge-edge overlaps

Edges are not allowed to overlap. This include touching of edges.

(Fig. 4)

4.2.1.5 Node orientation

Nodes have to be drawn horizontally or vertically, any other rotation of elements is not allowed.

(Fig. 5)

4.2.2 Recommendations

4.2.2.1 Node-edge overlaps

Crossing between edges and nodes should be avoided. Some crossings may be unavoidable, e.g. the crossing between an edge and a compartment border, or an edge and a complex (if the edge connects an element inside the complex with something outside). See also requirement 2.1.4 (In case of edge-node crossing the edge must be drawn on the top of the node).

4.2.2.2 Horizontal labels

Labels should be horizontal.

4.2.2.3 Avoid edge crossings

Crossings between edges should be minimized.

4.2.2.4 Units of information

Units of information should not hide the structure of the corresponding node.

(Fig. 6)

Some issues to discuss:

- Can we clarify the difference between 'simple' nodes (simple chemical, macromolecule, complex,…) and containers in the document?
- Shall we move the layout part from 3.3.9 in the specification (that the process target nodes are attached to the centre of opposite sides) to this chapter
- Several modifiers can touch the same transition node. Solution from discussion (to be changed in 3.3.9): the arcs from modifiers can end at different places (not necessarily centre of transition node)
- Complexes can span multiple compartments - shall we mention this in the layout section?
- Modules can span multiple compartments, but could be drawn anywhere - shall we mention this in the layout section?

Additional suggestions (appendix of specification)

Here is a list of additional layout suggestions which may help in producing aesthetically more pleasant layouts which may be easier to understand.

- Angle of edge crossings
  If edge crossings are not avoidable edges should cross with an angle close to 90 degree
- Placement of substrates and products of a transition
  Substrate and product nodes should be placed on different sides of the transition node
- Drawing area and width/height ratio
  The drawing should be compact and the ratio between the width and the height of the drawing should be close to 1
- Edge length
  Long edges should be avoided
- Number of edge bends
  Edges should be drawn with as few bends as possible
- Similar and symmetric parts
  Similar parts of a process diagram should be drawn in a similar way, and symmetric parts should be drawn symmetrically
- Proximity information
  Related elements (e.g. nodes connected by a transition or all elements within a compartment) should be drawn close together
- Directional information
  Subsequent processes (e.g. a sequence of reactions) should be drawn in one direction (e.g. from top to bottom or from left to right)