Tree Connector Subsystem

This subsystem describes the anatomy of a Tree Connector which connects from a position on one trunk Node face to a different position on one or more other branch Node faces. It can be used to express a generalization relationship on a class diagram. But there are surely other uses for this type of Connector on other Diagram Types.

Relationship numbering range: R151-R199

Class Descriptions

Anchored Tree Stem

Any Stem within a Tree Connector attached to a user specified anchor position is an Anchored Tree Stem.

Attributes

ID

Same as**Anchored Stem.ID** and **Tree Stem.ID**

Connector

Same as **Anchored Stem.Connector**. **Branch.Connector** and **Tree Stem.Connector**

Branch

Same as **Branch.ID**

Identifiers

1. **ID** + **Connector**

Branch Path

If the placement of a Branch can not be unambiguously computed by the specified grafts or Node face placement on the Diagram, the user must specify a Path aligned in some Lane. This user supplied information is a Branch Path.

Attributes

ID

Same as**Path.ID**

Connector

Same as **Path.Connector**

Identifiers

1. **ID** + **Connector**

Leaf Stem

Each Node participating in a leaf role within a Tree Connector attaches to the Connector via a Leaf Stem. This is generally an Anchored Stem, unless the Leaf Stem does not attach at a right angle to its Branch.

Attributes

ID

Same as**Anchored Branch Stem.ID** or **Floating Leaf Stem.ID**

Connector

Same as **Tree Connector.ID** and also same as**Anchored Branch Stem.Connector** or **Floating Leaf Stem.-Connector**

Identifiers

1. **ID** + **Connector**

Tree Connector

A Tree Connector connects a Node in a trunk role to one or more Nodes each in a leaf role in a hierarchical structure. It can be used to draw a generalization relationship on a class diagram, for example.

Attributes

ID

Same as**Connector.ID**

Identifiers

1. **ID**

Trunk Stem

Every tree connector pattern connects a single Node playing the role of a trunk with one or more other Nodes playing a leaf role. The Trunk Stem is an Anchored Tree Stem attached to the trunk Node.

Attributes

ID

Same as**Anchored Tree Stem.ID**

Connector

Same as **Tree Connector.ID** and **Anchored Tree Stem.Connector**

Identifiers

1. **ID** + **Connector**

Relationship Descriptions

OR161 / Ordinal

Branch bends corner at

In a Tree Connector with multiple Branches, each Branch is sequenced to establish adjacency. It must be possible, given a single Branch to move in either direction and find the adjacent Branch which must be oriented at a right angle. Starting from a Branch that originates at some Anchored Tree Stem, attached collinear or at a right angle, the Branch either terminates the Tree Connector at some other Tree Stem (anchored or floating) or it terminates at a corner which bends to form an adjacent Branch. This sequence continues until the final Branch terminates.

This ordering is important because it defines where the corner is located between two adjacent Branches.

Formalization

ID is an ordinal sequenced within a **Connector**

R151 / 1:1

Tree Connector is rooted in *one* **Trunk Stem**

Trunk Stem is root of *one* **Tree Connector**

We can visualize a hierarchical or tree connector pattern as originating in a trunk that extends out to one or more Branches which sprout one or more Leaf Stems. Here we establish that the Tree Connector must originate in a single Trunk Stem.

In the case of a class diagram generalization relationship, for example, the Trunk Stem would extend from the relationship's superclass.

Formalization

Referential attribute in the Trunk Stem class

R152 / 1:M

Tree Connector radiates out to *one or many* **Leaf Stem**

Leaf Stem sprouts from *one* **Tree Connector**

While there is only one Trunk Stem in a Tree Connector, there may be one or more Leaf Stems to form a hierarchical pattern. By policy, the pattern does not support a leaf-less tree.

In the example of a class diagram generalization relationship, each subclass would extend a Leaf Stem to attach to a Branch in the Tree Connector.

Formalization

Referential attribute in the Leaf Stem class

R153 / 1:M

Rut Branch follows *one* **Branch Path**

Branch Path guides *one* **Rut Branch**

The user can specify a Branch Path which establishes a Lane and a Rut where a Rut Branch is drawn. Only one Rut Branch may occupy the same Rut to avoid coincident or overlapping connector lines.

Formalization

Referential attribute in the Rut Branch class

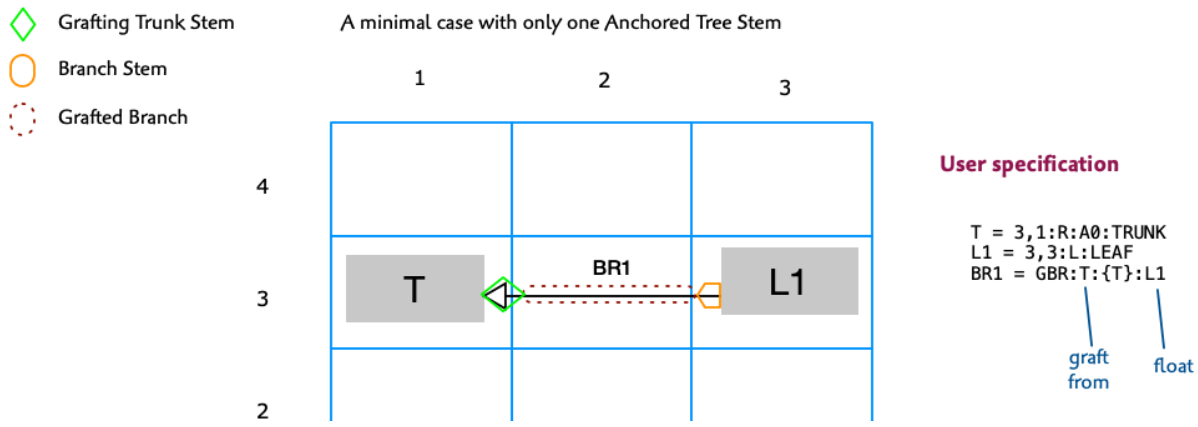
R154 / 1:M

Anchored Tree Stem hangs from *one* **Branch**

Branch hangs *one or many* **Anchored Tree Stem**

Every Branch has to connect at least one Anchored Tree Stem. In the minimal case (shown) this could be a Trunk Stem that grafts a Grafted Branch leading to a Floating Leaf Stem on the opposite side.

Pattern 7



Every Anchored Tree Stem must attach to a Branch at some point. This is either at a right angle to the Branch in which case the stem is hanging or it is in line with the Branch in which case the Branch is grafted from the Anchored Tree Stem.

Formalization

Referential attribute in the Anchored Tree Stem class

R155 / Generalization

Path is a **Branch** or **Binary Path**

At present there are two kinds of line segments that can be guided down a Row or Column by a Rut. In each case, a part of a bending Connector is proceeding in a straight line as guided by a Path specified by the User.

Since the rules for bending are specific to each Connector geometry, it is necessary to distinguish each type of Path.

Formalization

Referential attributes in the subclasses

R156 / 1:1c

Floating Leaf Stem is positioned by *one* **Grafted Branch**

Grafted Branch positions *zero or one* **Floating Leaf Stem**

Once a Grated Branch is established by an Anchored Tree Stem, it proceeds in a straight line and ends in one of three cases. It can end at a final Anchored Tree Stem hanging at a right angle to the Grafted Branch. If there is an adjacent Branch, it proceeds to where it meets that Branch at a right angle. In this case the Tree Connector is bending around a corner. In the third case, the Grafted Branch line meets the **Vine end** of a Floating Leaf Stem. As is the case with all Floating Stems, the user does not specify an anchor point

on the Stem's Node face. The point on the Node face is determined by projecting a line from the Grafted Branch to the face.

Formalization

Referential attribute in the Floating Leaf Stem class

R157 / 1:1c

Anchored Tree Stem establishes axis of *zero or one* **Grafted Branch**

Grafted Branch is a collinear extension of *one* **Anchored Tree Stem**

The line segment of a Branch can be defined by starting at the **Vine end** of an Anchored Tree Stem and extending on the same axis toward one or more other attached Tree Stems. If the Branch is defined in this manner it is a Grafted Branch.

By definition, a Grafted Branch extends out from some Anchored Tree Stem.

Most Anchored Tree Stems will not define a Grafted Branch and instead simply hang at a right angle from some Branch which may or may not be a Grafted Branch.

Formalization

Referential attribute in the Grafted Branch class

R158 / Generalization

Tree Stem is an **Anchored Tree Stem**or **Floating Leaf Stem**

Every Stem within a Tree Connector is either anchored or floating. The utility of this abstraction is not immediately clear. It is nonetheless true.

Formalization

The union of the subclass identifiers in the superclass as well as the referential attributes in each subclass.

R162 / Generalization

Branch is a **Grafted**, **Interpolated** or **Rut Branch**

There are three ways to determine the placement of a Branch. In the case of a Rut Branch the user specified a Path which establishes a Lane and a Rut. An Interpolated Branch is placed at the halfway point in between opposing Node faces. This is determined by taking all of the faces hanging in the Rut Branch, finding the two closest opposing faces and then identifying the halfway point between them. Finally, a Grafted Branch is collinear with a user specified Anchor Tree Stem.

Formalization

Referential attributes in the subclasses

R163 / Generalization

Anchored Tree Stem is a **Trunk Stem** or **Anchored Leaf Stem**

Every Anchored Stem in a Tree Connector attaches a Node in the trunk role (via its Trunk Stem) or in the leaf role (via its Anchored Leaf Stem).

Formalization

Referential attributes in the subclasses

R164 / Generalization

Leaf Stem is a **Floating Leaf Stem** or **Anchored Leaf Stem**

If a Leaf Stem is anchored to its Node it is either hanging at a right angle to its Branch or defining a grafting point from which its Grafted Branch is extended. It is also possible that a Leaf Stem is not anchored, but instead floats to be collinear with its Branch.

Formalization

Referential attributes in the subclasses

