# Scene Graph Hierarchy

This shows how all the elements pictured below (*Figure 1*) are hierarchically related in the program.

Please note that, even though S0.0.0 is an interface subsystem, it is a child of S0.0 and not of I0.0 because it is a second level interface subsystem.

All labels (not illustrated here) are root level entities.

Entities	Description
Snk-1.0	External sink
F-1.0	External outflow
S0	Root system
Snk0.0	Internal Sink
F0.0	Internal flow
S0.1	Subsystem
I0.0	Interface
S0.0	Interface subsystem
I0.0.1	Nested interface
S0.0.0	Nested interface subsystem

Figure 1: Nesting example
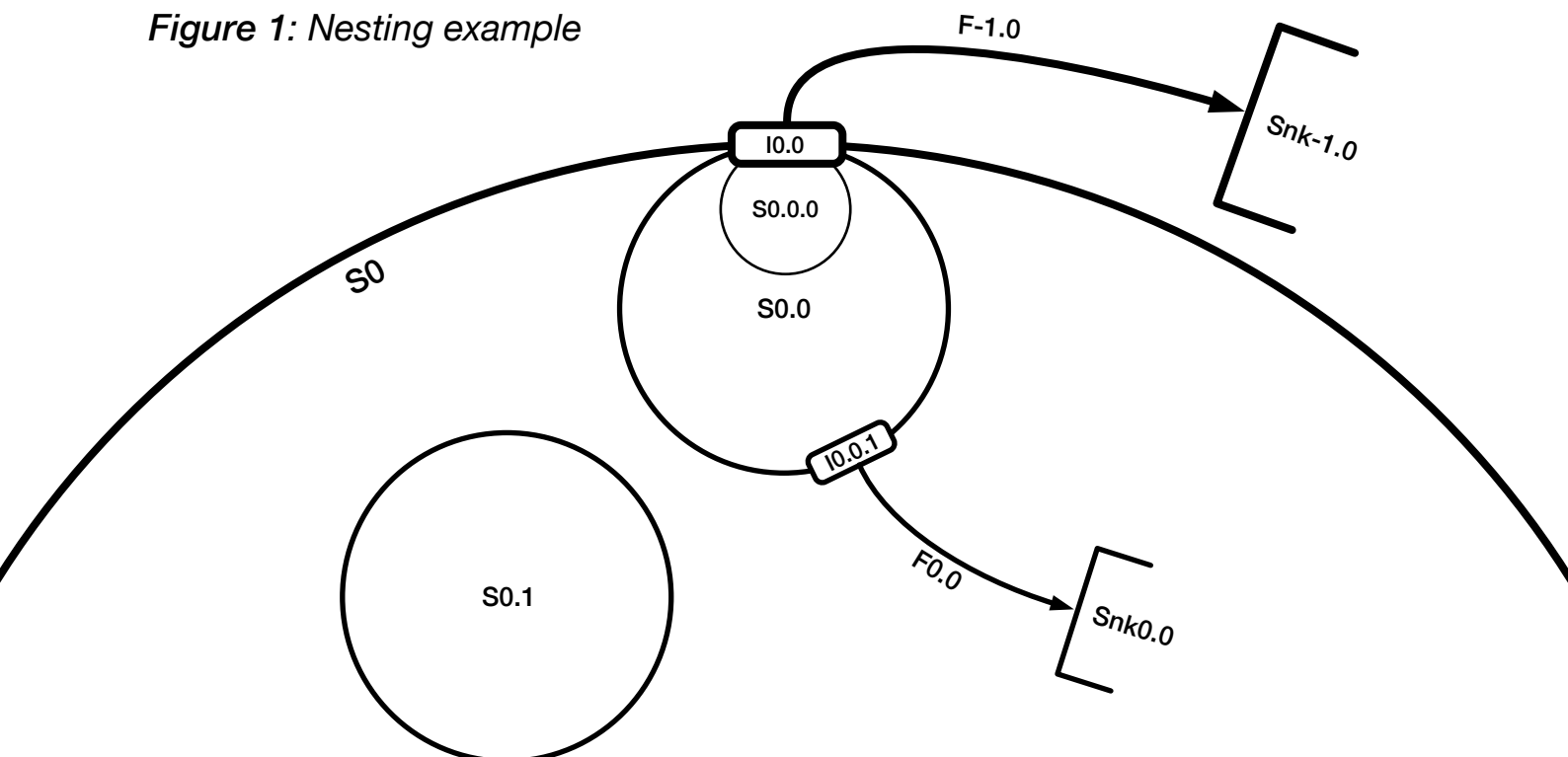
Zoom, Scale, Visibility and Nesting Level

Zoom is stored and modified as a `Resource`. It is not applied to the camera's matrix in the form of a scaling factor. The camera is moved however to always be centered on the same point relative to the world entities.

The zoom value is multiplied to the translations x and y of all entities. The z component stays unchanged. To provide a base value at zoom level 1 the component `InitialPosition` is used.

Systems

Only system entities change size according to the current zoom value. This is done by drawing a circle with it's base radius multiplied by zoom. The transform's scale is not changed.

Nesting Level

Labels, external entities and interfaces all have a maximum size and are only scaled down when the zoom factor falls below a certain threshold. To compute their scale their nesting level together with the zoom factor is considered.

All of these types of entities have a component `NestingLevel` attached which is just a `u16`. The table below illustrates what nesting levels the entities shown in *Figure 1* have.

The scale is computed like the following:

$$s = \min\{f^l \cdot z, 1\}$$

Entity	Nesting Level
Snk-1.0	0
F-1.0	0
S0	(No component) 0
Snk0.0	1
F0.0	1
S0.1	1
I0.0	1
S0.0	1
I0.0.1	2
S0.0.0	2

where

s Resulting scale

f Nesting factor. A fixed constant < 1 called `SUBSYSTEM_SCALING_FACTOR`

l Nesting level

z Zoom factor

This same scale calculation is also used to determine the line width of all entities (including systems).

Visibility

It is also used to determine the visibility of an entity. If the scale falls below a certain threshold the entity is hidden (`SCALE_VISIBILITY_THRESHOLD`, `LABEL_SCALE_VISIBILITY_THRESHOLD`).