Interaction Components and Lifecycle

Interactions (in the code still often called flows) are connected through different components to the entities that they connect. Different combinations of these connections are possible and only the ones applicable are present. They change during the lifecycle of an interaction and are added or removed depending on the stage in this lifecycle.

The lifecycle of an interaction has the following steps.

(1) Created from a system

(2) Connected through an interface at the system from step **(1)**

(3) Defined other end (source/sink or other system)

(4) **[*If other end is a system*]** Connected through an interface at the other end

Let's go through these steps in detail. In the illustrations below components are displayed like this: `Component`. If not specified differently the purple dashed connecting arrows mean that the `.target` field on the components holds the entity which the arrow is pointing towards.

(1) Created

When a flow is created from a system it is already connected to that system and a button to create the corresponding interface. *Figure 1* shows how this looks like when an outflow is created. In case of an inflow the component connecting the interaction to the system is called `FlowEndConnection`.

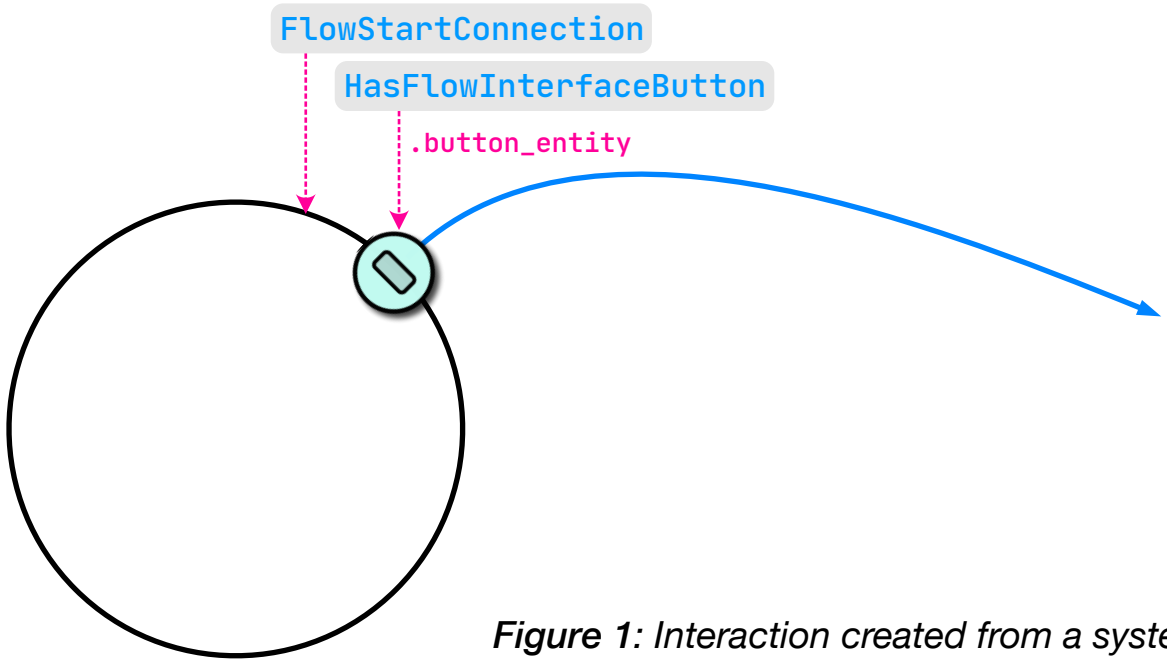

***Figure 1**: Interaction created from a system*

(2) Interface

When the create interface button is pressed the button together with `HasFlowInterfaceButton` is removed and an interface is created and connected through `FlowStartInterfaceConnection`.

At the other end a create sink button is added and the interactions is marked with the component `HasFlowOtherEndButton` to indicate that the button has been added. Please note that there is field connecting to the button entity, hence no arrow in *Figure 2* where this is illustrated. If this was an inflow a create source button would have been added instead.

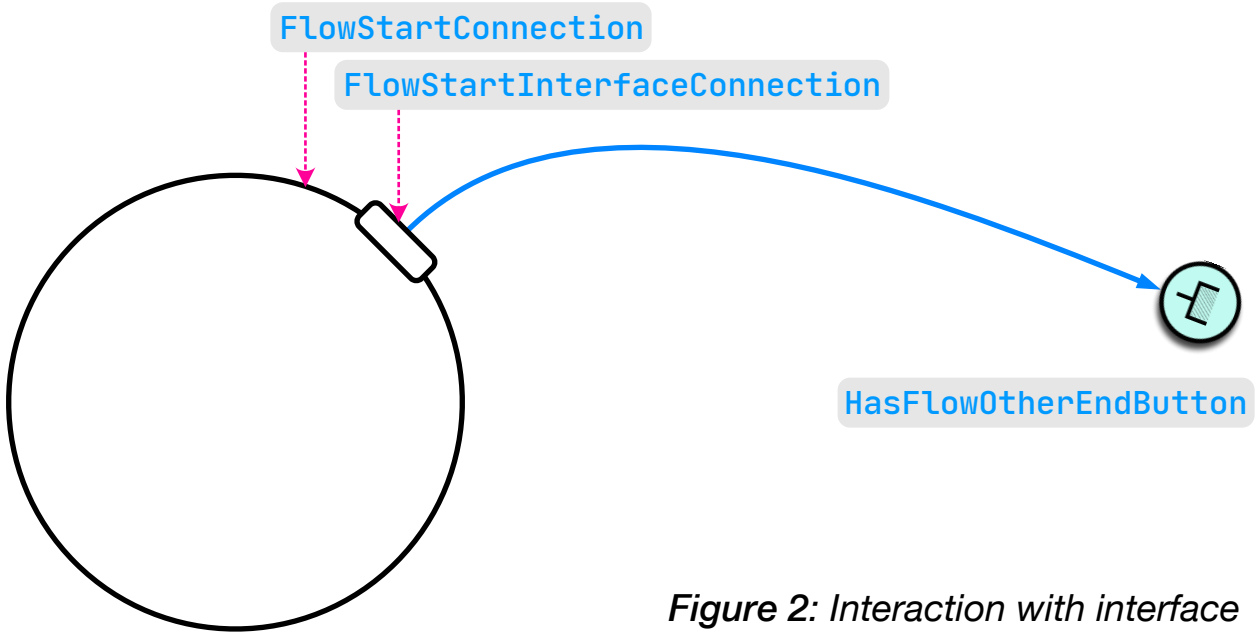

Figure 2: *Interaction with interface*

(3) Other End

If an interaction is created from the root system then clicking the source/sink button means that a source or sink is immediately created and connected through `FlowStartConnection` or `FlowEndConnection` respectively.

On the next page *Figure 3* shows how this looks like for an outflow and *Figure 4* for an inflow.

If an interaction is created from a subsystem pressing the source/sink button will make the corresponding end stick to the mouse cursor. If the user then clicks on free space the same happens as described above. However if another subsystem is clicked then that is connected through `FlowEndConnection` or `FlowStartConnection` as shown in *Figure 5* on the next page.

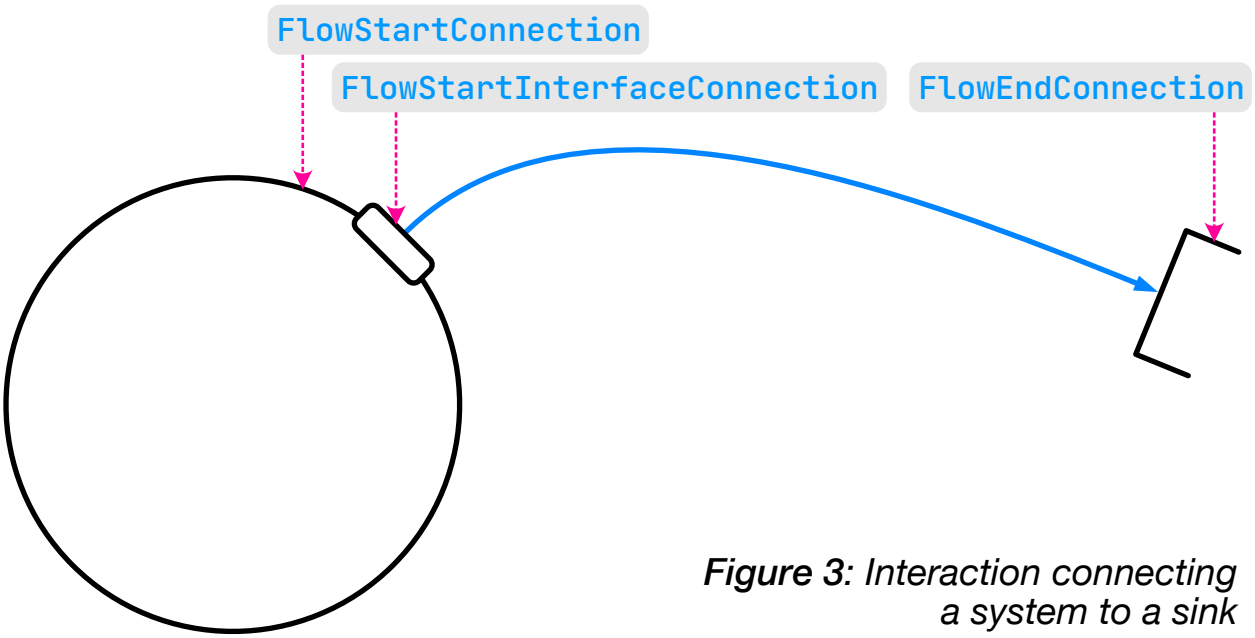

Figure 3: *Interaction connecting a system to a sink*

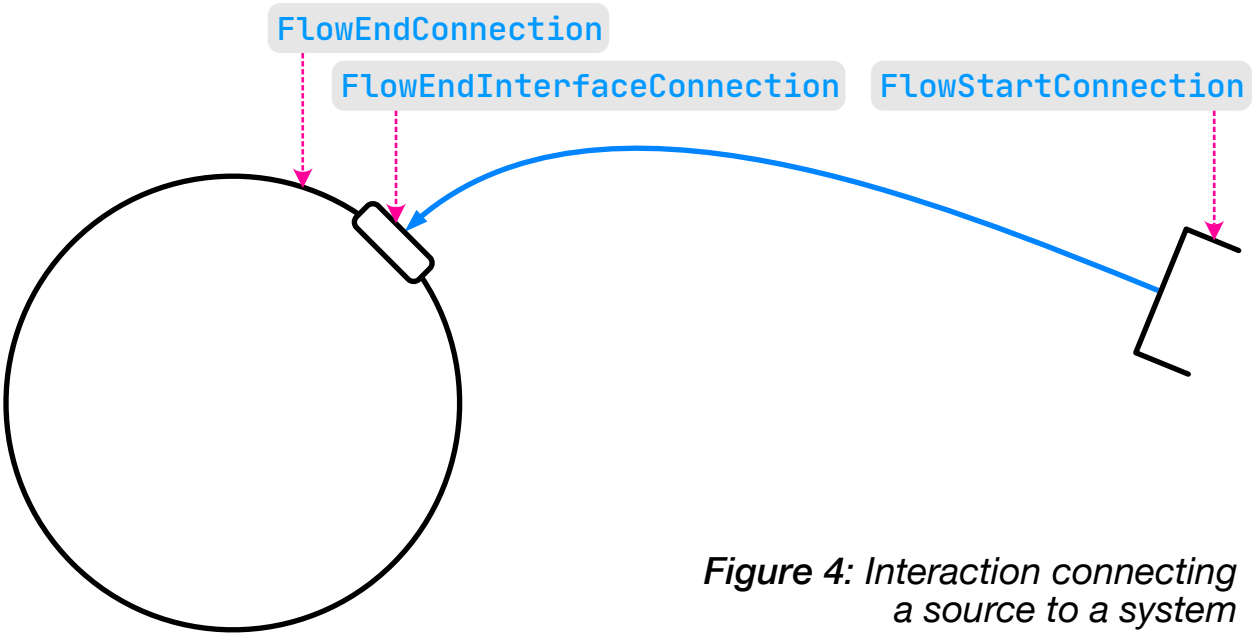

Figure 4: *Interaction connecting a source to a system*

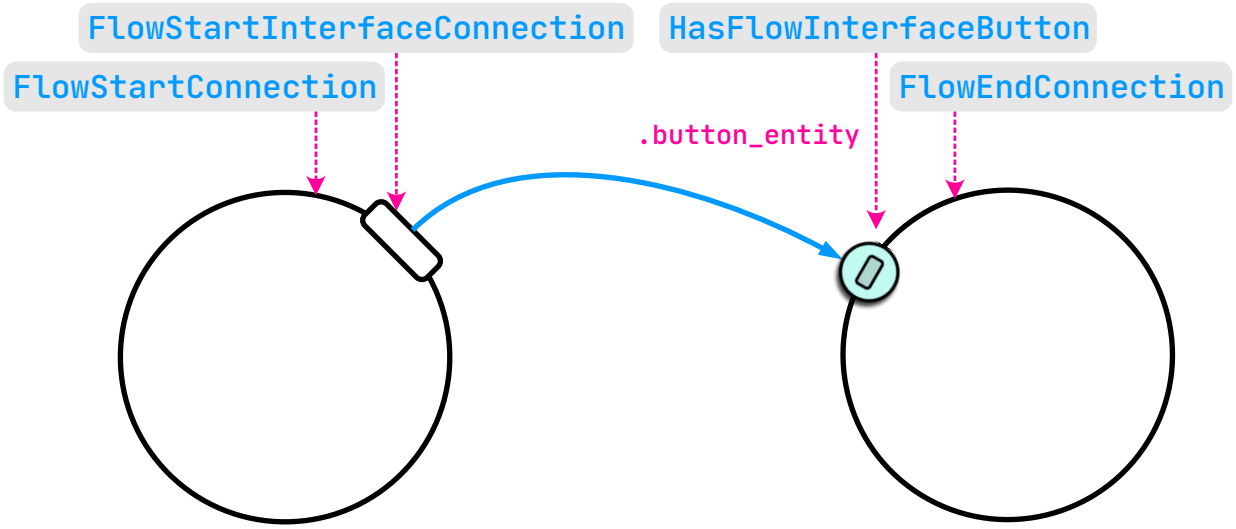

Figure 5: *Interaction connecting two systems*

The create interface button shown in *Figure 5* is only added when the target system is focused. Naturally, that's also exactly when the component `HasFlowInterfaceButton` is added.

(4) Interface at the Other End

This step only exists when two subsystems are connected. It is reached after the create interface button (as shown in *Figure 5*) at the other system is clicked. This behaves exactly the same as in step (2) and creates an interface together with a connecting component `FlowStartInterfaceConnection` or `FlowEndInterfaceConnection`. The result is shown in *Figure 6*.

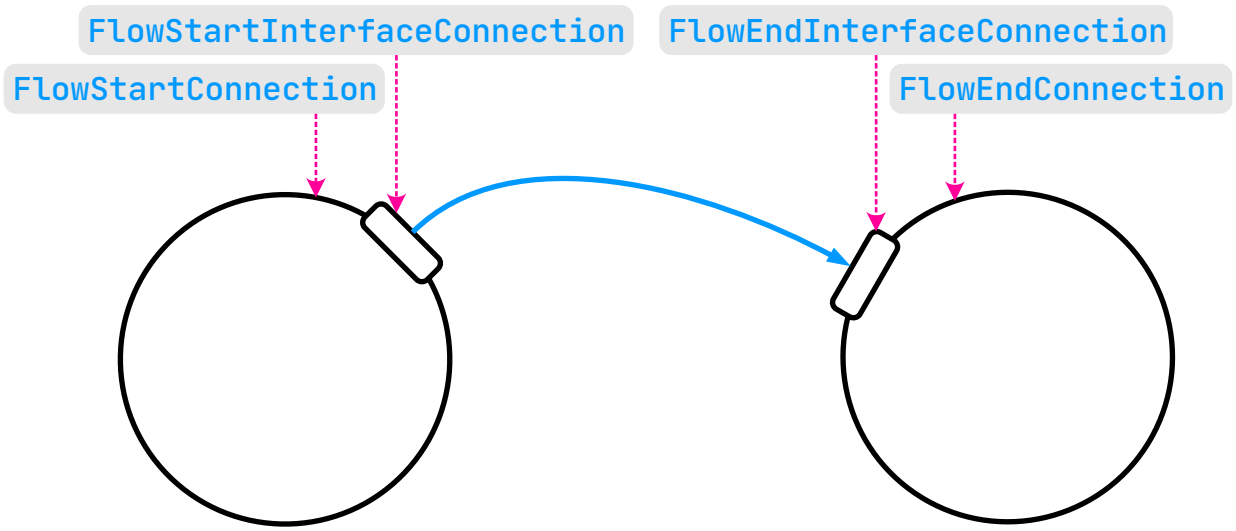

***Figure 6**: Interaction connecting two systems*

Removal of entities

When entities such as a source/sink or an interface is removed then the connecting interactions are updated accordingly. Connecting components are removed and appropriate buttons are added together with their corresponding components as described above. For example if a completely defined interaction connects a system to a sink and then this sink is removed then this interaction reverts to lifecycle step "(2) Interface" on page 2.

Through the removal of an interface of a completed interaction you can produce a 5th lifecycle step that is shown in *Figure 7* on the next page. It's a straight forward mix between step **(1)** and **(3)**.

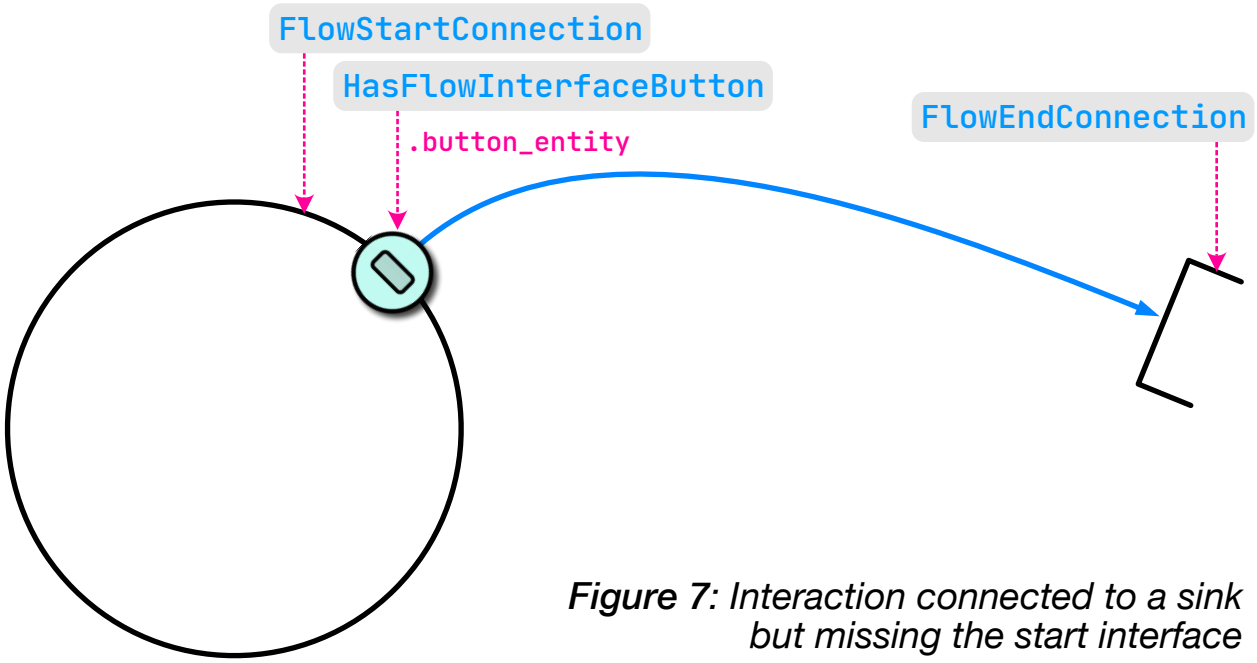

Figure 7: Interaction connected to a sink but missing the start interface

Permanent Components

Every interaction independent of it's current lifecycle step contains the components `Flow` and `FlowCurve`. They are added at the start when the interaction is spawned.

Flow defines the attributes of the flow like it's type, usability and amount.

The `FlowCurve` defines the curve of the interaction as the name suggests. It holds a **`start`** and **`end`** point as well as a **`start_direction`** and **`end_direction`** which are both unit vectors for the direction of the respective tangents. Please refer to the geometry documentation for more details how this is used and computed.