Riverware

Technical Documentation Version 8.0

Model Building
Quick Start

CU Center for Advanced Decision Support for
Water and Environmental Systems (CADSWES)

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Model Building Process Overview

In general, building a RiverWare model consists of the following steps. Some models require additional steps and others do not require all of these steps. This document describes these steps and provides links to documents with more information.

1. Select the Simulation Controller and set Run Times for a simulation run.

2. Pull objects off the Palette.

3. Select user methods on the objects.

4. Define your desired Unit Scheme.

5. Set timeseries ranges, enter, import, and export slot data.

6. Link objects together to define the basin topology.

Selecting the Controller and Setting Run Times

The next step in building a model is to select the controller and specify the run times and timestep for the run. These actions are performed from the Run Control dialog.

• Selecting **Control**, then **Run Control Panel**, or selecting the **Run Control** toolbar icon, brings up the Run Control dialog.
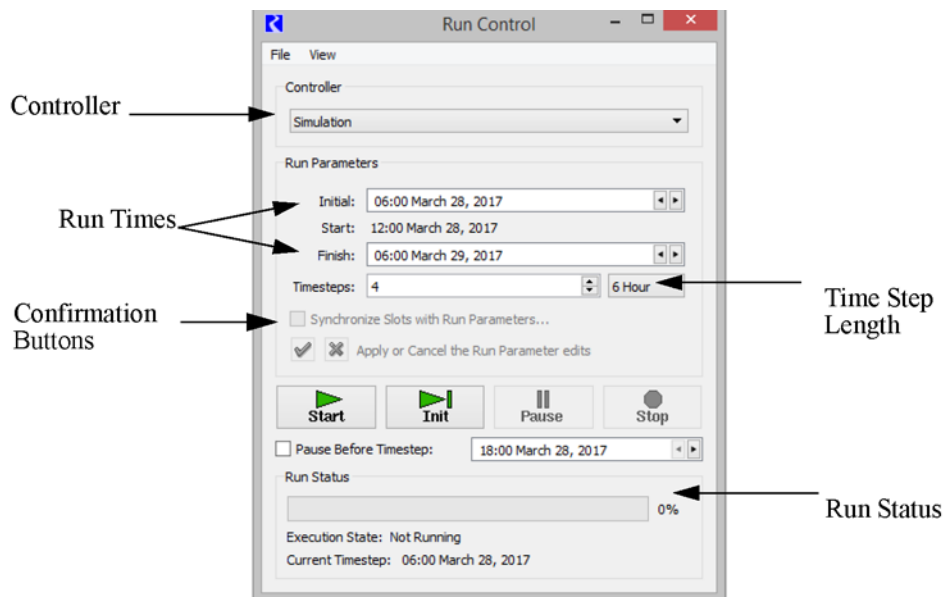
• From this dialog, specify the following:

  – Controller

  – Timestep length

  – Initial date

  – Finish date or number of timesteps.

See "Controllers" in *User Interface* for a detailed description of this dialog.

Objects on the Workspace

A model can be created on a blank workspace by selecting desired objects from the object palette and placing them on the workspace. The object icons are a convenient way to visualize the physical layout of a modeled system. These objects also contain the data and the physical process algorithms that drive the simulation.

The Object Palette

Objects are added to the workspace using the object palette. The Palette contains all of the available object types used to represent features of a river basin. It is the source from which objects are instantiated on the workspace. To place objects on the workspace, drag them off the object palette and place them in the desired location on the workspace. The object palette is accessed as follows:

- By selecting the object palette selector button on the main toolbar.

- Selecting **Workspace**, then **Objects,** then **Object Palette** from the menu bar.

- By right-clicking on the workspace. This will bring up a menu with an option to **Add Object**. Select the desired object to place it on the workspace.

The coordinates of the objects on the workspace are saved with the model so that objects will remain in position.
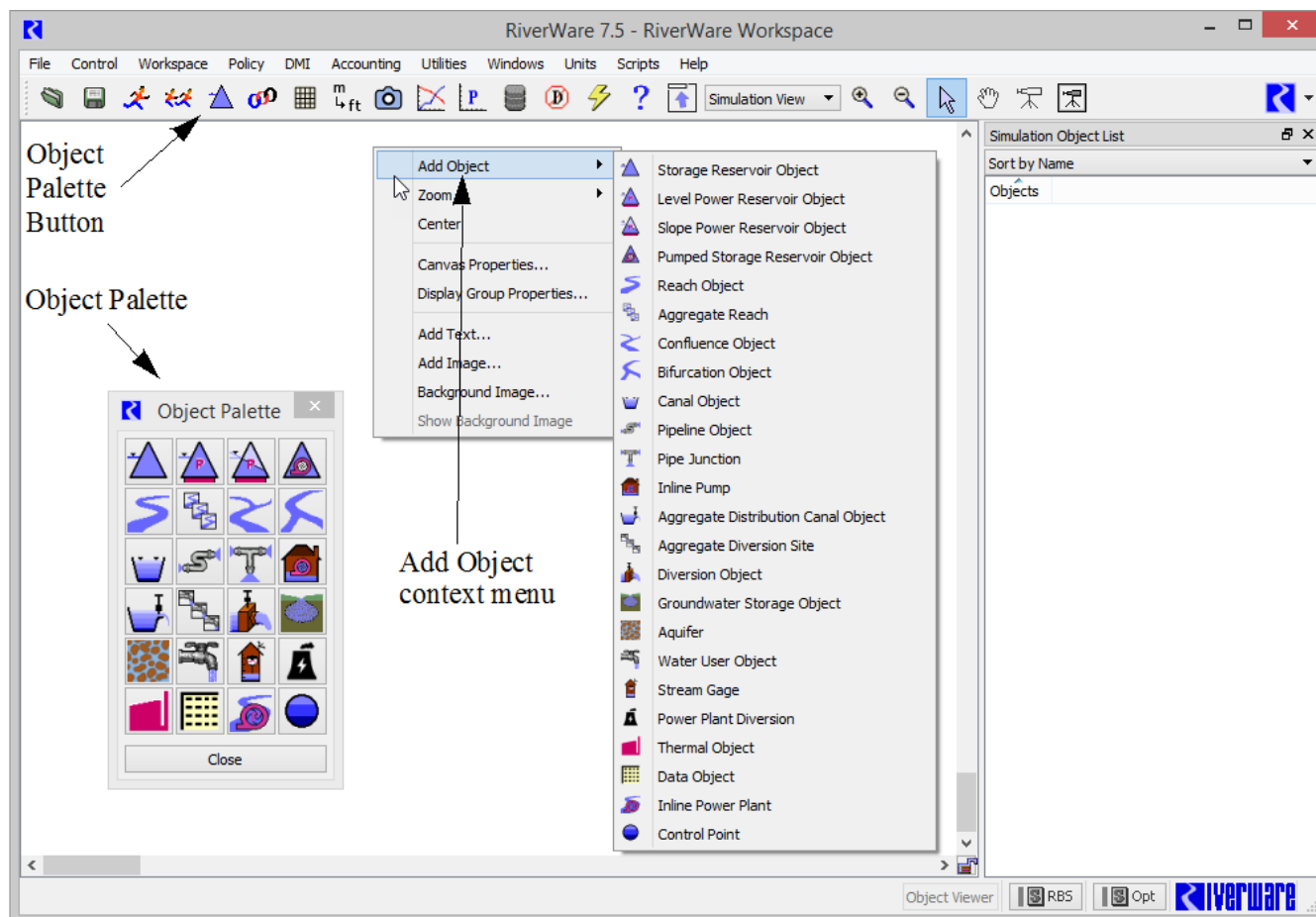
Pulling Objects Off The Palette

An object is created by selecting its icon and dragging it off the Palette onto the workspace. At the time an object is created, default attributes are defined by several sources. The first timestep and timestep size in SeriesSlots are matched to the Run Control run time settings. Display units and other slot configurations will conform to the currently active Unit Scheme; see "Unit Schemes" in *User Interface* for details. Default user methods are also selected for new objects. Slots associated with the selected controller and Methods are allocated in memory. See "Object Types" in *Objects and Methods* for details on each type of object.

See "Objects on the Workspace" in *User Interface* for details on managing objects, including selecting, importing, exporting, deleting, and clearing the workspace.

Configuring Objects

Objects are configured from the Object Viewer (or Open Object) dialog. See "Object Viewer and Open Object Dialogs" in *User Interface* for details on this dialog. The general steps to necessary to configure the objects are as follows:

- Name the object. See "Naming an Object" in *User Interface*.
- Select **User Methods**. See "Selecting Methods" in *User Interface*.

  Note: The Multi-Object Method Selector can be used to select methods on multiple objects in one action. See "Multiple Object Method Selector" in *User Interface* for details.

Defining Units

RiverWare stores all slot values in RiverWare internal units and performs calculations in these units (except where the algorithms do explicit conversions). You can display values in any User Unit that you wish. You define the user units, scale, precision and format by setting up a Unit Scheme. See "Unit Schemes" in *User Interface* for details on features of Unit Schemes.

Importing/Entering Data into slots

The next step in model building is to enter data into slots. See "File Menu" in *User Interface* for details.

Linking Slots on Objects

Links are the connections between slots on objects which pass information during a simulation run. They propagate a value from a slot on one object to a slot on a different object. Links are bidirectional in general, but in a pure simulation run, if values propagate in both directions during a single timestep, the model is overdetermined, and the run aborts.

A slot may be linked to more than one other slot. Also, several links may exist between different slots on two objects, but only one line is represented on the workspace.

Viewing Existing Links on the Workspace

In models with many links, it can be difficult to determine which objects and slots a particular link is connecting. By hovering over the link with the mouse cursor, all the connected objects and slots associated with that link are displayed in a tool-tip pop-up window as shown. The link name is also shown in the workspace status bar (lower

left corner). This can be useful because as long as the mouse is over the link, the name is shown in the status bar. Tool tips only show the name for a few second.
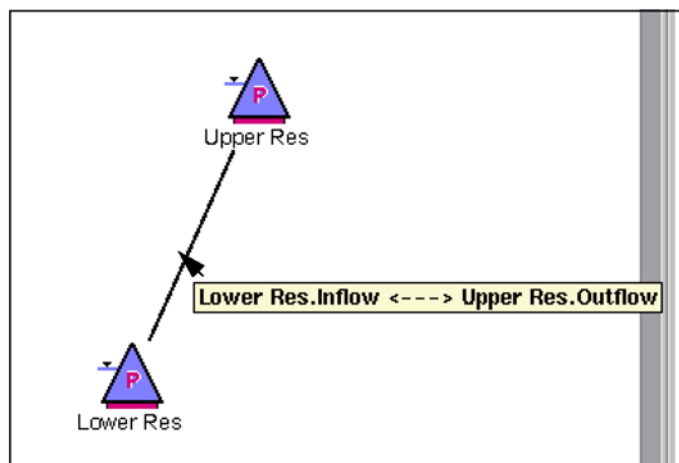
Also, in the Object Viewer (or Open Object), **Slots** tab, linked slots are marked with a . Right-clicking on a linked slot brings up a context menu. Highlighting **Linked Slots** displays a list of all slots linked to the selected slot. Selecting a slot on this context menu will open that slot.

Editing Links

There are three utilities for viewing, creating, and deleting links:

• Context Menus - Create links between any two slots on the workspace using the context menus. Delete any existing link from the workspace.

• Smart Linker - Create recommended links between two objects. Delete existing multiple links between two objects in one operation.

• Edit Links dialog - Create a links between any two slots. Delete any existing link.

These three approaches are described in the following sections.

Context menu

On the workspace, right-click context menus can be used to create or delete links as follows.

Creating Links

Use the right-click context menu **Link Slots** to link any two slots. Create links by first right-clicking on an object. A context menu dialog appears. Select **Link Slots** then select the slot you wish to link. A link is started. Then, right-click on another object to which the link will end. Select **Link Slots** and select the slot on that object. The link is created.

> **Note:** You can link any two dispatch slots in the model regardless if the link makes physical sense.

Deleting Links

Delete links between objects by hovering over the link and right-click. In the context menu, select **Delete Link** and select a link from the list. The link will be deleted.

Smart Linker

The Smart Linker simplifies the process of linking slots by recommending a set of links between two selected objects based on the type of object, their method selections, and the relationship between the two objects.

For example, if you select a reach and a groundwater object, and you have the Head Based Seepage method selected on the reach and the Head Based Groundwater Grid method selected on the groundwater object, the Smart Linker proposes the following links:

- **Reach.Previous Water Table Elevation** to **Groundwater.Elevation Previous** and **Reach.**

- **Seepage** to **Groundwater.Inflow from Surface Area**.

- If you are also modeling evaporation or salinity, another set of links are proposed.

    Note: The recommended links have been defined by CADSWES based on common modeling practices, experience, and existing models. It is possible that there are other slots that you may wish to link.

Accessing the Smart Linker

The Smarts Linker dialog is accessed by selecting two objects on the workspace, then one of the following:

- Right-clicking and choosing **Smart Linker**.

- Selecting the **Link** icon ![link icon] on the workspace and choosing **Smart Linker**.

- Choosing **Workspace,** then **Smart Linker** menu on the workspace.

If there are 0, 1, 3, 4... objects selected on the workspace, a warning box opens. You should select exactly two objects.
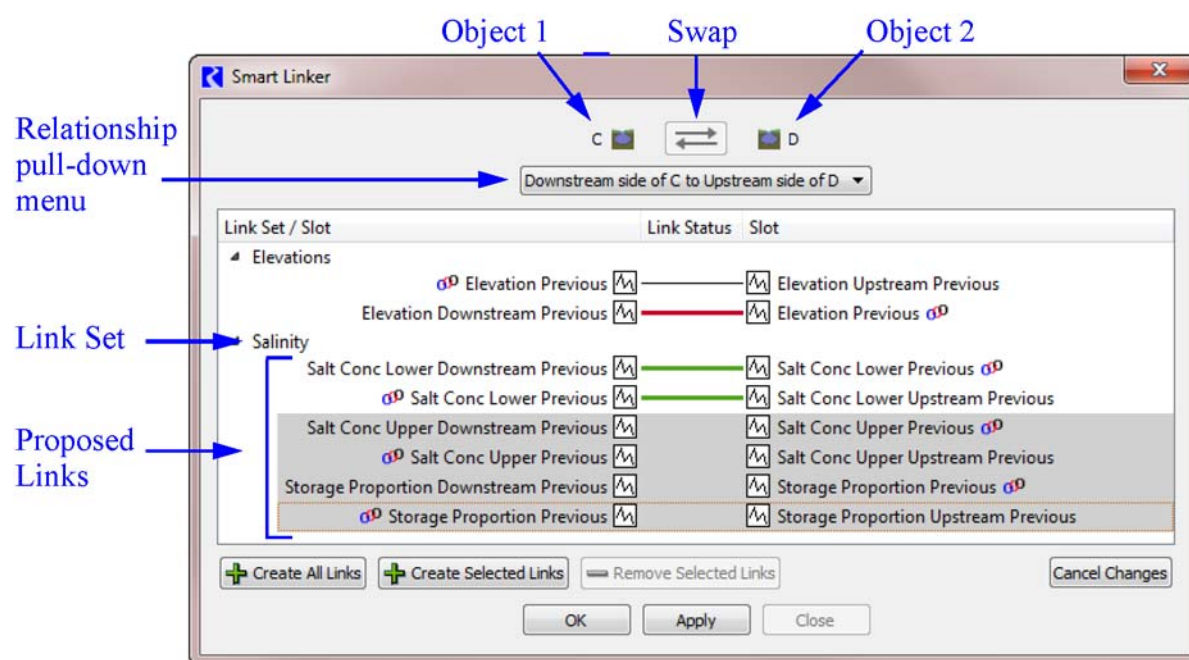
If the two selected object do not have any recommended links defined, a warning dialog opens. If you wish to link slots on these objects, use either the Link Slots context menu or the Link Editor.
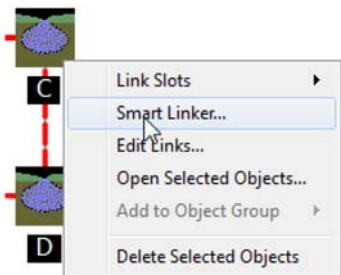
Overview

Following is screenshot of the Smart Linker tool followed by an overview of the tool.

Figure 1.1

The dialog shows the two selected objects at the top.The double-arrow button ⇄ swaps the two objects in the dialog (left to right). It is disabled when there are any un-applied link additions or removals, or if the reversed order is not supported.

The pull-down menu shows the available spatial relationships between the two selected objects. Use this pull down to indicate the relative position or relationship of the two objects. For example, is Object 1 upstream or downstream of Object 2. Possible examples include upstream / downstream, left / right, diverts from / diverts to, returns from / returns to. The selected relationship will lead to different recommended links.

Listed in the body of the dialog are sets of recommended links in a treeview with the specific slots shown.

Table 1.1 lists the meaning of each type of horizontal line that may appear in the Link Status column.

Table 1.1

Image	Color	Description
————	Thin black	An existing link.
————	Thick Green	A tentatively added link.
————	Thick Red	A tentatively removed link

Buttons along the bottom allows you to create or delete selected links. These changes are made tentatively; select **OK** or **Apply** complete the operation or **Cancel Changes** to cancel the changes.

Aggregate/Element Objects

Aggregate objects are handled a little differently. Because the Smart Linker is opened by choosing two objects on the workspace, there is no way to select an element, so the selection of the element is made in the Smart Linker.

When an aggregate object is shown in the Smart Linker, a toggle box labeled **Element** is shown. Leave it unchecked to link the aggregate object. Check the box and select the element to link the element object. For example, on the screenshot shown to the right, a reach element Reach0 will be linked to the aggregate diversion site.

Creating Links

To link the slots shown in a row, highlight the row and select **Create Selected Links**. Alternatively select the **Create All Links** button to create all the recommended links. The Link Status for that row turns to a green line. Select **OK** or **Apply** to actually create the links.

Deleting Links

Any existing link can be deleted by highlighting the row and selecting the **Remove Selected Links**. The Link Status for that row turns to a red line. Select **OK** or **Apply** to actually delete the link.

Using the Smart Linker

Following are basic steps to use the Smart Linker to create all the recommended links between two objects.

1. Select two objects on the workspace that you wish to link. Right-click and select **Smart Linker**.

2. In the Smart Linker, orient the two objects as desired using the swap button.

3. If applicable, use the pull-down menu to specify the relation ship of the two objects. After each change, a different set of slots will be listed as recommended links.

4. Create all of the recommended links by selecting the **Create All Links** button.

5. Select **OK** to create the links and close the dialog.

Link Editor

Sometimes the above links operations do not provide enough flexibility to view, create or edit links. In this situation the Edit Links dialog provides a comprehensive location to view, create, and delete links.
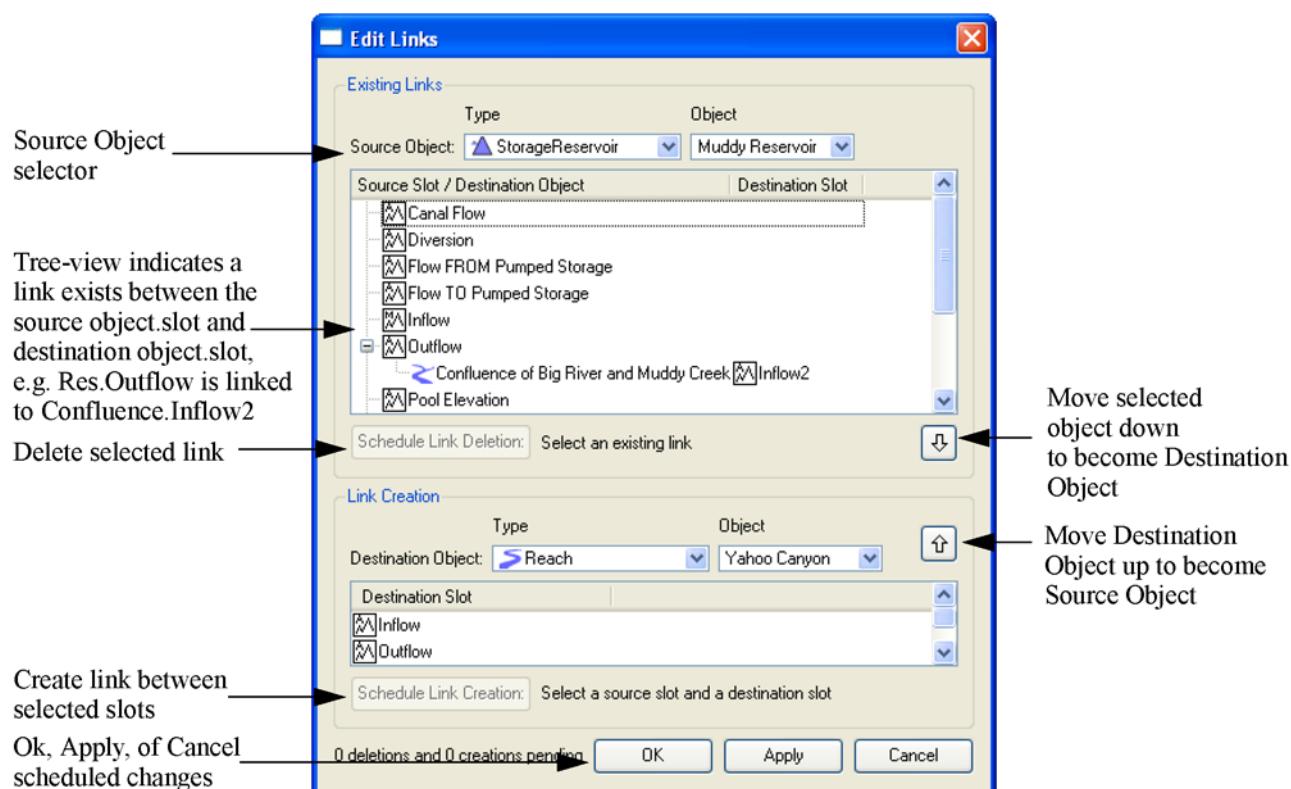
From the workspace, selecting **Workspace**, then **Edit Links** or selecting the **Link Editor** toolbar icon, and select **Edit Links**. The utility is shown in the following dialog.

Figure 1.2

Source Object selector

Tree-view indicates a link exists between the source object.slot and destination object.slot, e.g. Res.Outflow is linked to Confluence.Inflow2

Delete selected link

Move selected object down to become Destination Object

Move Destination Object up to become Source Object

Create link between selected slots

Ok, Apply, of Cancel scheduled changes

The Edit Links dialog is divided into two areas, one for Existing Links and one for Link Creation.

Existing Links - Viewing and Deleting

The upper portion of the dialog is used to view and delete existing links. A list of slots is generated by selecting a Source Object: **Type** and an **Object**. The list of all linkable slots on that object appears in the Source Slots tree-view list. Aggregate Objects show the upper level aggregate and each element with a "+" symbol to display the member slots, similar to the Object Viewer (or Open Object) dialog.

A slot in this dialog has a link if it has a "**+**" symbol to the left of its name. Selecting the "+" expands the tree view and shows all of the slots linked to the given slot by displaying the Destination Object and Destination Slot.

When the you highlight a row containing a Destination Object and Destination Slot, the **Schedule Link Deletion** button becomes active. Selecting this button will *schedule* the link for deletion; the link is actually deleted when the **Ok** or **Apply** button is selected. When a link is scheduled for deletion, the text is displayed with a strike through its name and a note next to the button.

> **Note:** You can create a link between two slots, then change methods on one or both of the objects such that the linked slots are no longer visible or in use. The link will remain on the workspace and in the Edit Links dialog, the Source Slot will be shown in *italics* to indicate that it is not currently visible in the model. You are prevented from creating links between non-visible slots, but links between non-visible slots can be deleted and viewed.

Creating Links

Both the upper and lower portion of the dialog are used to create new links. First select a Source Object: **Type** and **Object** in the upper portion of the dialog. Then select a Destination Object: **Type** and **Object** in the lower portion. Highlight the desired slot in the upper and lower lists and select the **Schedule Link Creation** button to *schedule* the link for creation; the link will actually be created when the OK or Apply button is selected. A link scheduled for creation is shown as green text and the tree view is automatically expanded.

Links can be created between any pair of slots when one slot is listed in the top half and the other slot is listed in the bottom half. These links may not all make physical sense, but any combination can be defined.

Moving the Destination Object to Become the Source Object

Often when using this dialog, you are creating a series of links in a specified order, say upstream to downstream. To

accommodate this, the up arrow button ⬆ can move the Destination Object in the link creation area up to

become the Source Object. Similarly, the down arrow ⬇ can be used to move the Source Object down to become the Destination Object. When using this button, the object in the selected row is moved down; thus, you can either select a slot (or make no selection) and the Source Object will move down. Or, you can highlight the linked Destination Object and Destination Slot row (via the tree-view) and selecting the **Down** arrow will move the selected destination object down to become the object selected in the link creation area.