Chapter 10 Implinks and Endpoints

Implementation links and endpoints are important concepts in the SOMT method (described in the SOMT Methodology Guidelines starting in chapter 69 in the User's Manual). This chapter describes the tool support for implinks and endpoints. The following topics are covered:

- **Link concepts**
- **How endpoints and links are visualized**
- **How to create links**
- **The Entity Dictionary window**
- **Link commands in menus**
- **The Paste As command**
- **The Link Manager tool**

Link Concepts and Overview

The SDL suite supports creating and maintaining links between different objects in a system. Such links are used to show relations between objects in different documents. Objects that may be linked are:

- Text fragments in text documents
- Graphical objects and symbols in OM, SC, HMSC, SDL and MSC diagrams (but **not** text fragments in such diagrams)
- Documents in the Organizer structure.

Implinks

The link concept in the SDL suite is designed to support the SOMT method, further described in the SOMT Methodology Guidelines starting in chapter 69 in the User’s Manual. In SOMT, an important relation is that one object can be seen as an implementation of another object. For this reason, links between objects are often referred to as implementation links, or *implinks*. For instance, a textual object in the requirement analysis may be implemented as an object class in the system analysis, and later as a process type in the design model.

Implinks are the result of a design decision taken during the development of a system. Using implinks enables traceability between the different models and phases, so that the usage of a particular object or concept can be followed from requirements all the way down to code. Another important aspect of implinks is that they facilitate consistency checks between the different models.

Links and Endpoints

A link has two *endpoints*, one at each of the objects that are linked together. Endpoints can be created for objects without creating a link, i.e. endpoints are entities separate from links. When a link is created, endpoints are created automatically, if they do not already exist. It is possible to have any number of links connected to an endpoint. Endpoints and links can be created from the Organizer and the editors.

Links are bidirectional, i.e. they can be traversed (followed) in both directions. Even so, a link has a “default” direction, defined when the link is created, to indicate the intended direction. This means that an endpoint is either a logical “from” endpoint, or a logical “to” endpoint.

A link has a name and optionally a comment. The name indicates the type of link, e.g. “implementation link”, and the comment is used to describe the link.

Link File

Information about endpoints and links is stored in a central *link file* (extension `.sli`), which is referred to from the Organizer’s system file. This approach makes it easy to get an overview of existing endpoints and links, and to make consistency checks. The link file is saved whenever the system is saved. The link file, and its defined links, are managed by a dedicated tool, the Link Manager (see “Tool Support and Operations” on page 432).

Information about endpoints are also stored in the individual documents. However, link information is only stored in the link file.

Local Link File

To make it easier to use the endpoint and link features in a multiuser environment, the concept of a *local link file* is provided. This is a personal link file for one user, storing all changes made to endpoint and link information compared to the global file, the *master link file*. A controlled merge operation is provided to update the master link file with the local link file information. These operations are available as services in the Telelogic Tau Public Interface (see *“Link File Services” on page 552 in chapter 12, The Telelogic Tau Public Interface*).

Visualization of Endpoints and Links

By default, endpoints are marked in a special way in the editors and in the Organizer. The markers are slightly different depending on whether or not any links are connected to the endpoint.

Endpoints in Graphical Editors

In the SDL Editor and the SDL suite diagram editors, the endpoint marker is a small triangle in the upper left corner of the object's enclosing rectangle. The triangle is filled if the endpoint has any links connected to it.

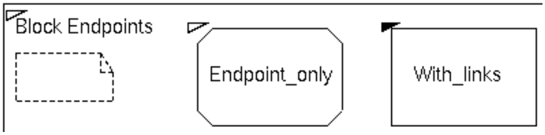


Figure 132: Endpoints with and without links

For lines in the SDL, OM. SC and HMSC diagrams, the marker appears on the name or signal list associated with the line. In SDL diagrams, it is also possible to create endpoints on other text elements associated with the line.

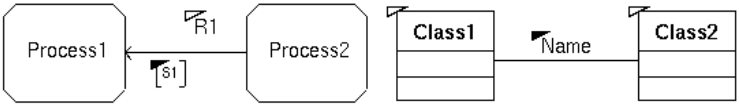


Figure 133: Endpoints on lines and text attributes

For lines in MSC diagrams (messages, timers, create requests), the marker normally appears at the "start" end of the line.

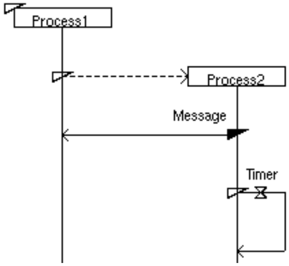


Figure 134: Endpoints on MSC lines

You can hide the endpoint markers by changing the option *Show Link Endpoints* in the *Editor Options* in the *View* menu, or by setting the editor preference ShowLinks to off.

Note:

Endpoint markers are never shown when printing a diagram.

Endpoints in Text Editors

In the Text Editor, endpoints are shown as underlined text, regardless if they have links connected to them or not. The endpoint text can be shown as normal text by changing the option *Show Link Endpoints* in the *Editor Options* in the *View* menu, or by setting the Text Editor preference ShowLinks to off.

In the Emacs editor **(on UNIX)**, endpoints without links are by default shown as blue, underlined text, whereas endpoints with links are shown as bold, blue, underlined text. The default font faces can be changed; see “Type Faces for Endpoints” on page 403 in chapter 7, *Emacs Integration*.

In MS Word **(in Windows)**, endpoints without links are shown as blue, underlined text, whereas endpoints with links are shown as bold, blue, double underlined text.

Endpoint text is always shown as normal text when printing a text document.

Endpoints in the Organizer

In the Organizer, the endpoint marker appears in the same way as in the graphical editors, i.e. a triangle in the upper left corner of the document icon.

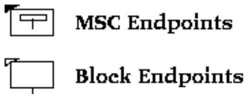


Figure 135: Endpoints in the Organizer.

The endpoint markers are always shown in the Organizer, and they are also shown when printing the Organizer window.

Tool Support and Operations

Operations on endpoints and links are supported in the Organizer, the diagram editors, the Text Editor and the Link Manager.

In the editors, the possible operations are identical and can be found in the *Link* submenu of the *Tools* menu (see “Link Commands in the Tools Menus” on page 442). The operations include:

- Creating and deleting an endpoint
- Creating and deleting a link
- Traversing a link (bringing the other endpoint into view)
- Opening the Link Manager

In the Organizer, the available operations in the *Tools* menu are limited to creating and deleting an endpoint, and opening the Link Manager.

In the editors, it is also possible to open the Entity Dictionary from the *Window* menu. The Entity Dictionary lists all endpoints in the system, together with the documents making up the Organizer structure. It is mainly intended for re-use of entity names, but also supports creating links. See “The Entity Dictionary” on page 434.

The Link Manager shows all endpoints and links in the system. It supports the following main operations:

- File operations on the link file
- Creating and deleting links
- Editing a link’s direction, name and comment
- Performing consistency checks on endpoints and links

It is not possible to create and delete endpoints in the Link Manager. For more information about the Link Manager, see “The Link Manager” on page 462.

Creating Links

There are basically three different ways to create links:

1. Manually, by linking together two endpoints.

   This operation requires two already existing endpoints. The endpoints may have been created manually, or as an effect of creating a link earlier.

   This operation is only available through the use of the Link Manager. See “Create Link” on page 468.

2. Manually, by linking together an endpoint and a selected object.

   This operation requires an already existing endpoint (selected in the Entity Dictionary), and a selected object in an editor. The endpoint may have been created manually, or as an effect of creating a link earlier. The selected object does not have to be an endpoint.

   This operation is available from the editors and the Entity Dictionary. See “Link > Create” on page 442.

3. Automatically, by copying and pasting an object (*Paste As*).

   This operation does not require any existing endpoints. An object is first selected and copied in an editor. The object is then pasted in an editor or in the Organizer by using the *Paste As* menu choice. This transforms the object, if necessary, and automatically creates a link between the copied and pasted object.

   This operation is available from the SDL, MSC, OM and Text Editors and the Organizer and supports the SOMT method. See “The Paste As Command” on page 448. It is **not** available in the SC/HMSC Editor.

The Entity Dictionary

The Entity Dictionary Concept

The purpose of the Entity Dictionary is to provide easy access to names of entities being used in the system, and a possibility to reuse these names in all parts of the system. The entities that the Entity Dictionary manage are all the link endpoints defined in the system, as well as all diagrams, documents and modules found in the Organizer structure.

The Entity Dictionary is accessible from the SDL suite editors. The names in the Entity Dictionary are available for reuse in all texts and graphical objects found in the graphical diagrams. However, the Text Editor does not support reuse of texts in text documents.

The Entity Dictionary is also used for creating links between objects and existing endpoints when using the editors.

Relations to Editor Windows

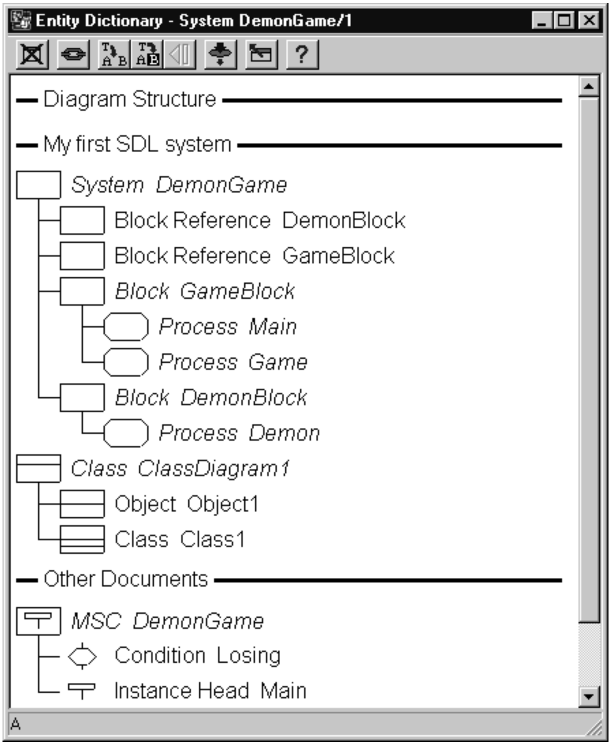
The Entity Dictionary is implemented as a modeless dialog window. There is not a single Entity Dictionary window, but one window for each type of diagram (SDL, MSC, OM, SC, HMSC and text). All Entity Dictionary windows contain exactly the same information, and all the windows are updated when a change is made. The reason for having an Entity Dictionary window for each editor type is that operations in the window apply to the object currently selected in the respective editor.

Since there might be several editor windows showing different diagrams/documents, there is a need to define the *current window*. This is the editor window that will be associated with the Entity Dictionary, and all operations will act on the current window. The current window is the editor window where the user last performed a menu command or a mouse click detected by the editor.

The editor associated with an Entity Dictionary window is known as the *parent editor*. The editor type is reflected in the window title of the Entity Dictionary window, thus making it possible to distinguish the different Entity Dictionary windows, and to determine the parent editor that the Entity Dictionary operations will affect.

Entity Dictionary Window

The Entity Dictionary Window can be opened from all of the editors through the use of the menu choice *Entity Dictionary* in the *Window* menu.



Entity Dictionary - System DemonGame/1

Diagram Structure

My first SDL system

System DemonGame
Block Reference DemonBlock
Block Reference GameBlock
Block GameBlock
Process Main
Process Game
Block DemonBlock
Process Demon
Class ClassDiagram1
Object Object1
Class Class1

Other Documents

MSC DemonGame
Condition Losing
Instance Head Main

A

Figure 136: The Entity Dictionary window

Contents and Structure

The window lists all the defined link endpoints, following the structure of diagrams and files in the Organizer. By default, every item in the Organizer is repeated, and the indentation of items is also repeated. All Organizer items and link endpoints listed in the window are known as *entities* in the Entity Dictionary.

Below each Organizer item, the link endpoints defined in that item are listed with indentation:

- Below each SDL diagram, the symbols marked as link endpoints are listed.
- Below each MSC diagram, the instances, messages and other symbols marked as link endpoints are listed.
- Below each OM diagram, the names of all the classes, instances and other symbols marked as link endpoints are listed.
- Below each text document, the text fragments marked as link endpoints are listed.

For an Organizer item that contains both sub-documents and link endpoints, the endpoints are listed first, followed by the sub-documents.

It is possible to hide the Organizer items to display only the link endpoints; see “The Filter Dialog” on page 440 for more information.

The information in the Entity Dictionary is updated whenever a link endpoint is created, changed or cleared in any of the editors or the Link Manager, or when the Organizer structure is modified.

Entity Icons

Each entity has an associated icon that identifies the type of the entity, i.e. the type of the endpoint object. Entities that already have an established icon in the Organizer or the Index Viewer use the same icon in the Entity Dictionary, with a few exceptions. The icons specific to the Entity Dictionary are:

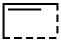


Diagram Heading

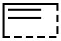
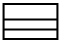
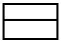
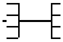


Diagram Extended Heading


OM Class


OM Object


OM Association

OM Aggregation

OM Generalization

SC Transition

MSC Message

MSC Create

MSC Timer Set

(H)MSC Reference

HMSC Start

HMSC Stop

HMSC Connection

Text symbols and text fragments

Textual Notation

The type and name of an entity is shown to the right of the icon. For entities containing a name, such as diagram symbols, this name is listed. For other symbols and text fragments, the first 25 characters are shown.

The cases when a diagram reference symbol, a diagram heading, or an Organizer document is an endpoint will result in duplication of information in the Entity Dictionary. To distinguish between such endpoints and the structure of Organizer documents, the following textual notations are used:

- Link endpoints are listed using a plain font face.
- Documents and other Organizer items that are not endpoints are listed using an *italic font.*
- Endpoints that are diagram reference symbols contain the word “Reference” after the diagram type.
- Endpoints that are diagram headings has the word “Heading”, “Additional Heading” or “Extended Heading” as the entity type.

Figure 136 on page 435 shows examples of these textual notations.

Operations in the Entity Dictionary

The Entity Dictionary window does not contain a menu bar. Operations are available as quick buttons or as popup menus.

Quick Buttons

The following quick buttons are special to Entity Dictionary window.

Close
Close the Entity Dictionary window.

Create Link
Create a link between the endpoint selected in the Entity Dictionary and the object selected in the parent editor. The quick button is dimmed if not two such selections are present. If the parent editor is a Text Editor, the selected text must be an already existing endpoint.
The *Create Link* dialog is opened; see Figure 139 on page 443.

Insert
Insert the text in the selected symbol in the Entity Dictionary at the insertion point in the object selected in the parent editor. The quick button is dimmed if not two such selections are present. If text is selected in the parent editor's text window, this text is instead replaced.
This button is not available in the Text Editor's Entity Dictionary.

Replace
Replace the text content of the object selected in the parent editor with the text in the selected symbol in the Entity Dictionary. The quick button is dimmed if not two such selections are present.
This button is not available in the Text Editor's Entity Dictionary.

Undo
Undo the most recent text operation in the Entity Dictionary (Insert, Replace, Undo). The quick button is dimmed if the selection in the parent editor has changed to another object.
This button is not available in the Text Editor's Entity Dictionary.

Filter
Filter the information listed in the Entity Dictionary. See "The Filter Dialog" on page 440 for more information.

Show Editor
Raise the parent editor window.

Popup Menus

The following tables lists the available operations in the popup menus of the Entity Dictionary window.

On the Window Background

Appears when no symbol is selected and the menu is invoked in an area not containing any symbols.

Expand All	Expands all collapsed symbols.
Collapse All	Collapses all symbols; only root symbols will be shown. Collapsed symbols are indicated with a small triangle directly below the symbol.
Show Editor	Raises the parent editor's window.

On a Document Symbol

Appears if an Organizer document symbol is selected, or the menu is invoked where a document symbol is selectable.

Expand	Expands a collapsed symbol one level down.
Expand Substructure	Expands the entire substructure of the symbol.
Collapse	Collapses the substructure of the symbol.

On an Endpoint Symbol

Appears if an endpoint symbol is selected, or the menu is invoked where an endpoint symbol is selectable.

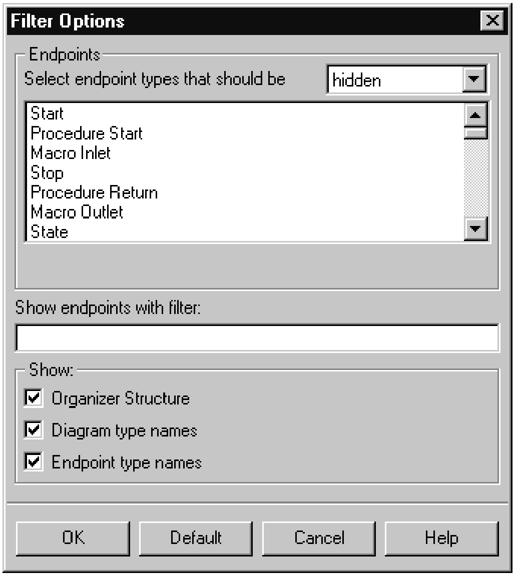
Show Definition	Brings up an editor window, or the Organizer window, where the endpoint is selected.

Double-Clicks

If there is a selection in the parent editor and a symbol in the Entity Dictionary is double-clicked, the text of the symbol is inserted in the parent editor. A double-click thus corresponds to using the *Insert* quick button; see “Insert” on page 438. This functionality is not available in the Text Editor's Entity Dictionary.

The Filter Dialog

The Filter dialog is opened when the *Filter* quick button is pressed in the Entity Dictionary window. The Filter dialog controls what is to be shown in the Entity Dictionary window.



Filter Options

Endpoints

Select endpoint types that should be: hidden

Start
Procedure Start
Macro Inlet
Stop
Procedure Return
Macro Outlet
State

Show endpoints with filter:

Show:

☑ Organizer Structure
☑ Diagram type names
☑ Endpoint type names

Figure 137: The Filter dialog

- *Select endpoint types that should be*

  This option menu controls whether the selected endpoint types should be *hidden* or *shown*. The possible endpoint types are shown in a multiple selection list, in which any number of items can be selected. If the option menu is set to *shown*, only the selected endpoint types are listed in the Entity Dictionary. If the option menu is set to *hidden*, the selected endpoint types are hidden, and the ones not being selected are thereby shown.

- *Show endpoints with filter*

  This text field is a pattern for matching endpoint names. Only endpoints whose names match the pattern are shown in the Entity Dictionary. The string has the same syntax as a normal UNIX file pattern, and may contain the elements '*' (zero or more characters), '?' (exactly one character), and '[...]' (any character within the brackets).

  An empty text field matches any name, i.e. it is equal to a single '*'.

- *Organizer Structure*

  This option controls whether the documents making up the Organizer structure are shown. If not set, only endpoints are listed in the Entity Dictionary.

- *Diagram type name*

  This option controls whether the diagram type names in the Organizer structure are shown. If not set, only the names of the diagrams are shown in the Entity Dictionary.

- *Endpoint type names*

  This option controls whether the endpoint type names are shown. If not set, only the names of the endpoints are shown in the Entity Dictionary.

- *Default*

  Resets the Filter dialog to its default settings, but does not close the dialog. The default settings are:

  – The endpoint type list contains no selection.
  – The endpoint type option menu is set to *hidden*.
  – The endpoint name filter is empty.
  – The three Show options are set.

Link Commands in the *Tools* Menus

This section describes the link-related commands that are available in the *Link* submenu in the *Tools* menu of the Organizer and all SDL suite editors.

> **Note:**
>
> None of these commands are possible to *Undo*.
>
> The Organizer only supports a subset of the link commands.

The *Link* submenu contains the following menu choices:

- *Link > Create*
- *Link > Create Endpoint*
- *Link > Traverse*
- *Link > Link Manager*
- *Link > Clear*
- *Link > Clear Endpoint*

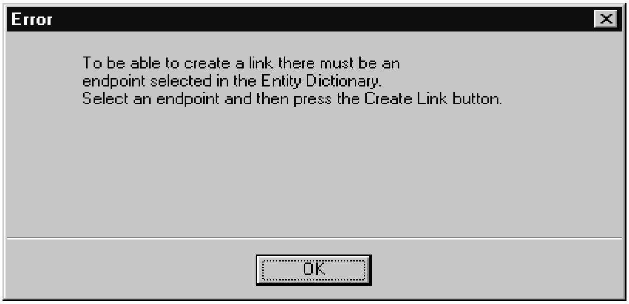
Link > Create

This menu command creates a link between the object selected in the editor and the object selected in the Entity Dictionary. If two such objects are selected, the Create Link dialog is opened (see Figure 139 on page 443). The editor object does not need to have a link endpoint defined to be able to create a link, i.e. only one of the objects need to be present in the Entity Dictionary. It is possible to create a link to itself.

> **Note:**
>
> In the Text Editor, the selected text must already be a link endpoint. It is not possible to create links to text that is not an endpoint.

If no object is selected in the editor, or no endpoint is selected in the Text Editor, the menu command is dimmed.

If no object is selected in the Entity Dictionary, or the Entity Dictionary has not been opened, a warning dialog is issued (see Figure 138) and the Entity Dictionary window is opened or raised. When the dialog is closed and the instructions given in it are followed, the Create Link dialog is opened.

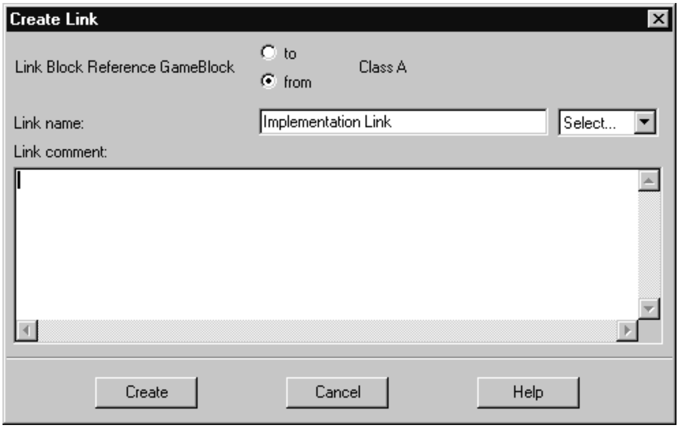


Error

To be able to create a link there must be an endpoint selected in the Entity Dictionary.
Select an endpoint and then press the Create Link button.

Figure 138: The Create Link warning

The Create Link dialog looks like this:



Create Link

Link Block Reference GameBlock ○ to ● from Class A

Link name: Implementation Link

Link comment:

Figure 139: The Create Link dialog

- *Link <editor object> to/from <entity dictionary object>*

  The two selected objects are listed at either side of the *to/from* radio buttons. The radio buttons control which of the objects that is to be the logical to and from object. *Link to* is the default.

- *Link name*

  The name of the link. A name can be entered or edited in the text field, or be selected from the associated option menu. The five latest used link names when creating links will be available in the option menu, and the name in the text field is preset to the latest used link name. A link name **must** be specified.

- *Link comment*

  An optional comment text, to be provided by the user. The text box is initially empty.

- *Create*

  Creates a link between the two objects. The link will be visible in the Link Manager and the endpoint objects are marked as being an endpoint with at least one link, i.e. if the editor object was not already an endpoint, it will be created.

If the Entity Dictionary window was opened because of the Create Link command, it will stay up until the user explicitly closes it.

Link > Create Endpoint

This menu command defines the currently selected object as a link endpoint. The endpoint is immediately added to the Entity Dictionary and the Link Manager. The object is marked as a link endpoint in the invoking tool – an editor or the Organizer. (See “Visualization of Endpoints and Links” on page 430.)

This command is dimmed if not exactly one object that can be defined as a link endpoint is selected, or if the object already is an endpoint.

This command is also available in the popup menus of all editors and the Organizer.

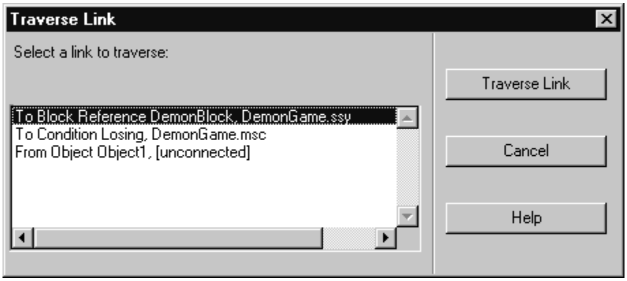
Link > Traverse

This menu command traverses an existing link from the currently selected object. This is done by opening the tool where the other link endpoint is defined (an editor or the Organizer) and selecting the other endpoint object.

This command is dimmed if more than one object is selected, or if the selected object has no links defined.

This command is also available in the popup menus of all editors and the Organizer, as *Traverse Link*.

If there is only one link defined from the object, that link is traversed, as described above. If more than one link exists, a dialog showing all links is opened and one of the links has to be selected.



Traverse Link

Select a link to traverse:

To Block Reference DemonBlock, DemonGame.ssy
To Condition Losing, DemonGame.msc
From Object Object1, [unconnected]

Figure 140: The Traverse Link dialog

The dialog presents a list of all links to and from the object in the following form:

`From|To` *<type and name of linked object>, <file name>*

The type and name of the linked object follow the same notation as in the Entity Dictionary; see “Textual Notation” on page 437. The file name of the document where the linked object is found contains a path if the file is not in the Organizer’s Source Directory.

- To traverse a link, select the link and click the *Traverse Link* button, or double-click the link.

Link > Link Manager

This menu command opens or raises the Link Manager window. If exactly one object is selected and this object is a link endpoint, this endpoint will be selected and made visible in the Link Manager. This command is never dimmed.

For more information about the Link Manager, see “The Link Manager” on page 462.

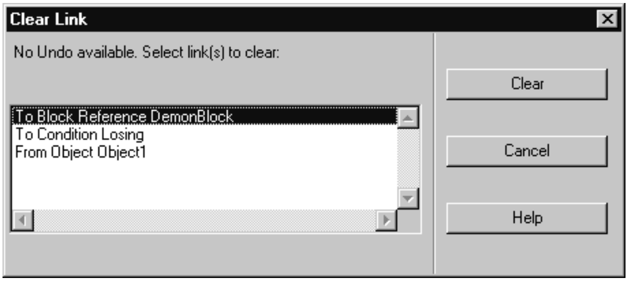
Link > Clear

This menu command removes one or more links to or from the currently selected object. However, the link endpoints are preserved. This command is dimmed if more than one object is selected, or if the selected object has no links defined.

Caution!

Removing a link cannot be undone.

A dialog showing all links is opened and one or more of the links has to be selected.



Clear Link

No Undo available. Select link(s) to clear:

To Block Reference DemonBlock
To Condition Losing
From Object Object1

Figure 141: The Clear Link dialog

The links to and from the object are listed in the following form:

`From | To` *<type and name of linked object>*

The list of links is a multiple selection list, in which one or more links can be selected. When a selection is made in the list, the *Clear* button becomes active.

To remove links, select the links in the list and click the *Clear* button. A link is removed from both endpoint objects, but the link endpoints themselves are **not** removed. If either of the endpoint objects had only this link defined, and no others, the mark of the object changes to indicate that the object is only an endpoint with no links defined. For information on how to remove an endpoint, see “Link > Clear Endpoint” on page 447 (below).

Link > Clear Endpoint

This menu command removes the link endpoint from the currently selected object, and subsequently all links connected to the endpoint.

This command is dimmed if more than one object is selected, or if the selected object is not an endpoint.

If the selected object has no links connected to the endpoint, the endpoint is removed without further user interaction. The endpoint is removed from the Entity Dictionary and the Link Manager. The object is no longer marked as a link endpoint in the invoking tool (an editor or the Organizer).

> **Note:**
>
> In the Text Editor, this command can also be used to reduce the extent of an already existing endpoint. If the selection only indicates a partial range of the endpoint, at the start or end of the endpoint, a dialog will appear allowing you to choose whether to remove the entire endpoint, or just remove the selected part of the endpoint from the selection.
>
> If a partial range in the middle of the endpoint text is selected, the only possibilities are to remove the entire endpoint or cancel the operation.

If the selected object has one or more links connected to the endpoint, a warning dialog is opened, since the operation of removing a link cannot be undone:

The *Paste As* Command

The command *Paste As* is available in the *Edit* menu of the Organizer and in the SDL suite editors (except for SC or HMSC diagrams).

The Paste As command is used to paste a copied object as another object, and at the same time create an implementation link between the copied and pasted objects. It is also possible to paste a cut object, but in this case no link can be created.

It is possible to paste the object into an editor different from the one the object was copied from. This requires a transformation of the object according to the user's choice.

Paste As supports the SOMT method, which governs the possible transformations for a particular object. See the SOMT Methodology Guidelines starting in chapter 69 in the User's Manual for information and advice on when to use a particular transformation.

> **Note:**
>
> The normal *Paste* command in the *Edit* menu is very different from *Paste As*. A normal paste can only be performed in the same editor as the object was copied from, and the pasted object is as far as possible an identical copy of the object.

The Paste As Process

The process of using Paste As consists of the following steps:

1. Copy (or cut) an object to the clipboard.

   A **single** object is selected and copied to the clipboard by using the *Copy* command in the *Edit* menu of the editor. The Paste As command supports the following objects being copied:

   – A class symbol in an OM Editor.
   – An object symbol in an OM Editor.
   – A text fragment in a Text Editor that either contains no endpoints or exactly matches an endpoint.

   It is thus not possible to use Paste As with copied SDL or MSC symbols, or with Text symbols copied in an OM Editor.

2. Paste the object using *Paste As*.

   In the desired editor or the Organizer, the *Paste As* command is selected from the *Edit* menu. The menu choice is dimmed if:

   – More than one object was copied.

   – An object different from the list above was copied.

   – The copied object cannot be pasted into the tool, i.e. there is no transformation defined for this particular object–tool combination. The possible transformations are listed in “Transformation Scheme” on page 452.

   After selecting the menu choice, the Paste As dialog is opened. See “The Paste As Dialog” on page 450.

3. Select the type of object to paste the copied object as.

   In the Paste As dialog, the possible resulting object types are listed in an option menu. The object types listed reflects the transformations possible for this particular copy–paste situation. If the desired object type is not present in the list, the user may have to change which object is being copied, the editor where the paste is made, or (for the SDL Editor) the type of SDL diagram being pasted into.

4. Select the type of link to create, if any.

   In the Paste As dialog, it is possible to change the default of creating an “Implementation Link” between the copied and pasted objects. See “The Link Info Dialog” on page 451. If the object was cut instead of copied, no link can be created.

5. Place the pasted object.

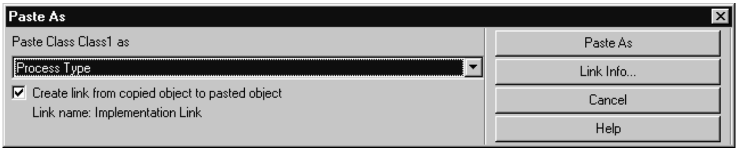
   If the pasted object is a graphical symbol, a “floating” symbol must be placed with the mouse in the usual way, and the paste can be cancelled by pressing `<Esc>`. If the pasted object is a textual description or an Organizer document, the object is placed at the text cursor or the current selection.

6. Edit the pasted object, if needed.

   The results of the object transformation may not be complete or accurate. The user may need to change the pasted object to achieve the desired result.

The *Paste As* Dialog

The Paste As dialog is opened when *Paste As* is selected from the *Edit* menu.



Paste As

Paste Class Class1 as

Process Type

☑ Create link from copied object to pasted object

Link name: Implementation Link

Figure 142: The Paste As dialog

- *Paste <copied object> as*

  The option menu contains all possible types of objects that can be created in the current situation; in some cases, only a single alternative is available. A default object type is pre-selected. The possible object types and the default are presented in “Transformation Scheme” on page 452.

- *Create link from copied object to pasted object*

  This option controls whether a link is to be created between the copied and pasted objects. This is by default set, and the link will always be made from the copied object to the pasted object. If the object was cut instead of copied, this option is dimmed.

- *Link name: <link name>*

  States the name of the link to create, and is only valid if the *Create link* option is set. By default the link name is “Implementation Link”, but this can be changed in the Link Info dialog; see below.

- *Paste As*

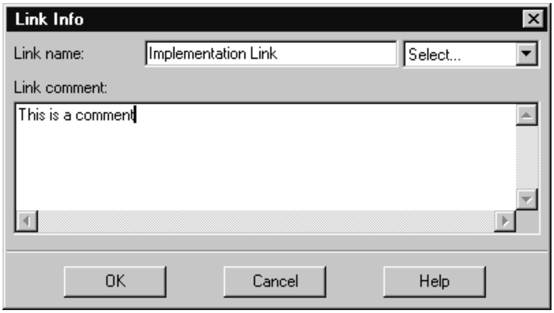
  Closes the dialog, creates an object of the selected type, pastes it in the invoking tool (the Organizer or an editor), and optionally creates a link. In graphical editors, pressing `<Esc>` cancels the paste.

- *Link Info*

  Brings up the *Link Info* dialog (see below), where the attributes of the link can be changed before it is created. This button is dimmed if the *Create link* option is dimmed or not set.

The *Link Info* Dialog

The *Link Info* dialog is opened when the *Link Info* button is pressed in the *Paste As* dialog.



Link Info

Link name: Implementation Link

Link comment: This is a comment

Figure 143: The Link Info dialog

- *Link name*

  An editable text field specifying the name (type) of the link to create. The name is preset to “Implementation Link”. The five latest used link names when creating links is available in the *Select* option menu. Selecting a name from this menu inserts the name into the text field.

  The link name text field must not be empty.

- *Link comment*

  An optional comment text to be provided by the user. The text in the comment field is initially empty. The comment associated with a link can only be viewed and changed later on by using the Link Manager.

Transformation Scheme

The table below presents all the possible object type combinations for the copied and pasted object in the Paste As operation. The preselected choice shown when the Paste As dialog is opened is shown in **bold face.**

Copied object	Paste As in OM Editor	Paste As in SDL Editor	Paste As in MSC Editor	Paste As in Text Editor	Paste As in Organizer
Class (in OM Editor)	**Class** Object	System Type Block Type Block **Process Type** Process Service Type Service Text symbol with NEWTYPE Text symbol with SDL interface	—	**C++ class** C struct IDL Module IDL interface ASN.1 sequence	**System**
Object (in OM Editor)	**Class** Object	Block instance **Process instance** Service instance	—	—	**System**
Text fragment (in Text Editor)	**Class** Object	—	**Instance** Message	**Text fragment**	**MSC**

Note:

Not all object types are possible to Paste As in all situations. Especially in the SDL Editor, the available object types depend on which diagram type the Paste As is performed in.

Transformation Details

The details of the specific object transformations are described in the following subsections. Please refer to the above table to see which tools that support a particular object transformation.

Some general transformation details are:

- The name of a copied symbol can be empty. When pasted as an SDL diagram, the name "EmptyName" will be used.
- In SDL diagrams, if the name used for a pasted symbol will be in conflict with an already existing name, the pasted name will be the original name suffixed by "_<number>". For example, if "Name" already exists for a reference symbol in an SDL diagram, the pasted symbol will have the name "Name_1". The number is incremented until the name is unique.
- The size of the pasted SDL, MSC and OM symbols are the same as when a symbol is manually picked from the editor's symbol menu.
- The exact layout of generated diagrams may not be depicted correctly in the following illustrations. Only the upper left part of a diagram is shown.

Pasting an OM Class

An OM class may be represented and defined by several class symbols in the OM diagrams. This is the case if more than one class symbol with exactly the same class name is found within the OM scope (the diagram itself or the diagrams in the same Organizer module).

When an OM class is pasted, **all class symbols defining the class in the scope are considered**. It is the combined set of attributes and operations in the class symbols that will be used in the transformation to the pasted object.

In the following descriptions of object transformations, we use the two class symbols shown in Figure 144 (within the same scope) as a generic example. Regardless of which class symbol is copied, both class symbols are considered in the transformations.

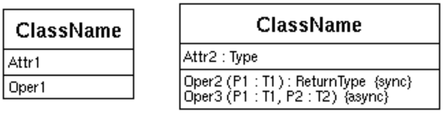
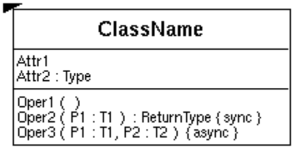
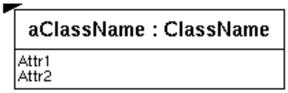
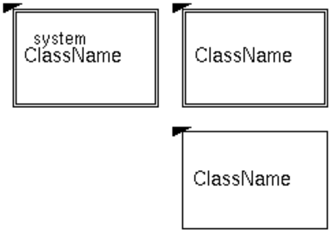
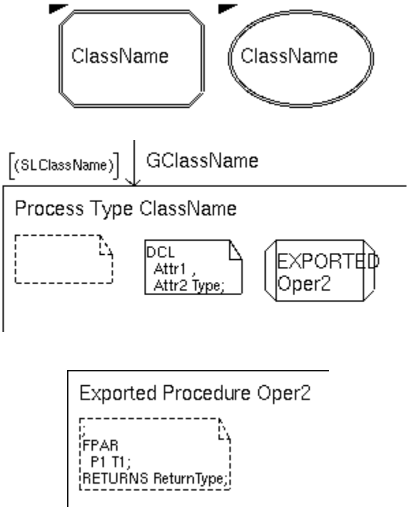

ClassName
Attr1
Oper1
ClassName
Attr2 : Type
Oper2 (P1 : T1) : ReturnType {sync}
Oper3 (P1 : T1, P2 : T2) {async}

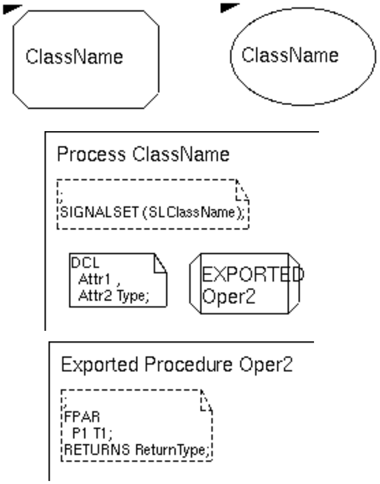
Figure 144: Two class symbols in the same scope

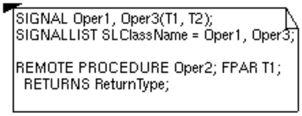
Note:

Even if there are more than one class symbol in the scope, only the copied symbol will be linked with the pasted object (if a link is created). Links are not created for the other symbols in the scope.

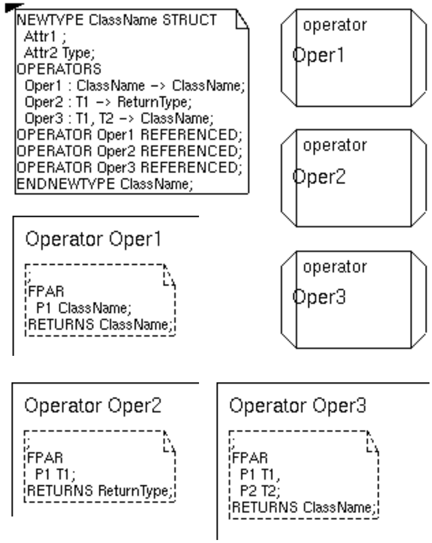
Paste As object, with description	Resulting objects and diagrams
Class symbol The pasted class is simply a copy of the merged class.	 ClassName Attr1 Attr2 : Type Oper1 ( ) Oper2 (P1 : T1) : ReturnType { sync } Oper3 (P1 : T1, P2 : T2) { async }
Object symbol The pasted object contains the merged attributes of the class. The object is named ‘a’ followed by the class name.	
System Type diagram **Block Type diagram** **Block diagram** In these cases, only a reference symbol is created, not any contents of the diagram.	

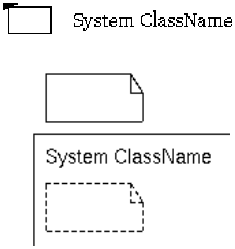
Paste As object, with description	Resulting objects and diagrams
Process Type diagram **Service Type diagram** A reference symbol is created, as well as the referenced diagram with some contents. The keyword “{async}” after an operation means that it will be transformed using a signal interface. A gate named ‘G’ followed by the class name, and a signal list named “SL” followed by the class name, is added. The keyword “{sync}” after an operation means that it will be transformed using an RPC interface. The procedure diagram is created with an additional heading symbol containing FPAR and RETURNS statements for parameters and return type. If no keyword is given, signal interface is the default for operations without return value, and RPC interface is the default for operations with return value. **NOTE:** Text symbols containing the declarations of the signal list and the remote procedures must be created by a separate Paste As operation, usually in a diagram at a higher level. See “Text symbol with SDL interface” on page 456 (below).	 ClassName ClassName (SLClassName) GClassName Process Type ClassName DCL Attr1 , Attr2 Type; EXPORTED Oper2 Exported Procedure Oper2 FPAR P1 T1; RETURNS ReturnType;

Paste As object, with description	Resulting objects and diagrams
Process diagram **Service diagram** The same transformation as for process type and service type, but the signal interface is added as a SIGNALSET statement in the additional heading symbol. **NOTE:** Text symbols containing the declarations of the signal list and the remote procedures must be created by a separate Paste As operation, usually in a diagram at a higher level. See “Text symbol with SDL interface” on page 456 (below).	 ClassName ClassName Process ClassName SIGNALSET (SLClassName); DCL Attr1 , Attr2 Type; EXPORTED Oper2 Exported Procedure Oper2 FPAR P1 T1; RETURNS ReturnType;

Text symbol with SDL interface
A text symbol is added, containing declarations for the signal list and/or remote procedures, as described for process type and service type above.
	
	SIGNAL Oper1, Oper3(T1, T2);
	SIGNALLIST SLClassName = Oper1, Oper3;
	REMOTE PROCEDURE Oper2; FPAR T1;
	RETURNS ReturnType;

Paste As object, with description	Resulting objects and diagrams

Text symbol with NEWTYPE
A text symbol is added, containing a NEWTYPE definition. Operator diagrams are added for all operations, with additional heading symbols containing FPAR and RETURNS statements for parameters and return type.
If an operation does not have parameters, a parameter is inserted with the class name as type. The class name is also used as return type if an operation does not specify any.
	
	NEWTYPE ClassName STRUCT
	Attr1 ;
	Attr2 Type;
	OPERATORS
	Oper1 : ClassName -> ClassName;
	Oper2 : T1 -> ReturnType;
	Oper3 : T1, T2 -> ClassName;
	OPERATOR Oper1 REFERENCED;
	OPERATOR Oper2 REFERENCED;
	OPERATOR Oper3 REFERENCED;
	ENDNEWTYPE ClassName;
	 operator Oper1
	operator Oper2
	operator Oper3
	Operator Oper1
	FPAR
	P1 ClassName;
	RETURNS ClassName;
	
	FPAR
	P1 T1;
	RETURNS ReturnType;
	
	FPAR
	P1 T1,
	P2 T2;
	RETURNS ClassName;

System diagram In the Organizer, the system diagram is added in the same way as for the *Add New* operation, i.e. the diagram is added as a new root diagram at the current selection. The diagram is also opened in the SDL Editor.	

C++ class definition
The link to the class definition is inserted inside a C++ comment.
	`// class ClassName`
	`class ClassName {`
	`public:`
	`  void Oper1();`
	`  ReturnType Oper2(T1 P1);`
	`  void Oper3(T1 P1, T2 P2);`
	
	`private:`
	`  Attr1;`
	`  Type Attr2;`
	`};`

Paste As object, with description	Resulting objects and diagrams

C struct definition
 	
The link to the struct definition is inserted inside a C comment.
	`/* struct ClassName */`
	`typedef struct {`
	`  Attr1;`
	`  Type Attr2;`
	`} ClassName;`
	
	`void Oper1(ClassName *);`
	
	`ReturnType Oper2(ClassName *,`
	`                 T1 P1);`
	
	`void Oper3(ClassName *,`
	`           T1 P1, T2 P2);`

IDL module
 	
Only the class name is used.
The link to the module is inserted inside an IDL comment.
	`// module ClassName`
	`module ClassName {`
	`};`

IDL interface
 	
Operations marked with keyword “{async}” will get the string `oneway void` inserted before the name of the operation.
The link to the interface is inserted inside an IDL comment.
	`// interface ClassName`
	`interface ClassName {`
	`  attribute Attr1;`
	`  attribute Type Attr2;`
	
	`  oneway void Oper1();`
	`  ReturnType Oper2(T1 P1);`
	`  oneway void Oper3(T1 P1,`
	`                    T2 P2);`
	`};`

ASN.1 sequence
 	
The link to the sequence is inserted inside an ASN.1 comment.
	`// ClassName SEQUENCE`
	`ClassName ::= SEQUENCE {`
	`  Attr1,`
	`  Attr2 Type`
	`}`

Pasting an OM Object

In a similar way as when pasting an OM class, all object symbols of exactly the same class in the scope are considered. It is the combined set of attributes in the object symbols that will be used in the transformation to the pasted object.

In addition, the class that the object is an instance of is also considered, if it exists. That is, it is the combined set of attributes and operations in the class symbols and the objects symbols that will be used in the transformation.

In the following descriptions of object transformations, we use the object symbol shown in Figure 145 as a generic example. In addition, the object is assumed to be located in the same scope as the two class symbols shown in Figure 144 on page 454.

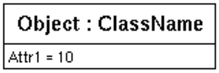
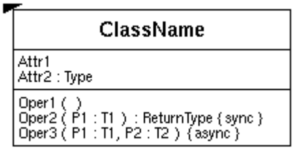
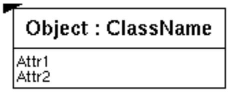
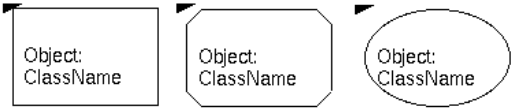


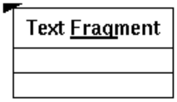
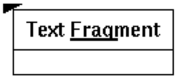
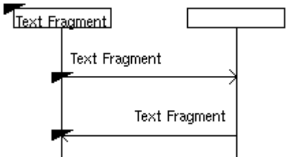
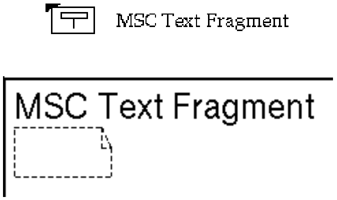
Figure 145: An Object symbol

Paste As object, with description	Resulting objects and diagrams
Class symbol The pasted class uses the class name, attributes and operations from the copied object and the object's class symbols.	 ClassName Attr1 Attr2 : Type Oper1 ( ) Oper2 (P1 : T1) : ReturnType { sync } Oper3 (P1 : T1, P2 : T2) { async }
Object symbol The pasted object uses the name and attributes from the copied object and the object's class symbols, but without attribute values.	
Block instance diagram **Process instance diagram** **Service instance diagram** The pasted diagram becomes an instance diagram (indicated in the Organizer).	 Object: ClassName Object: ClassName Object: ClassName
System diagram Works in the same way as when pasting an OM class. The name of the diagram will be "Object : ClassName".	See "System diagram" on page 457.

Pasting a Text Fragment

In the following descriptions of object transformations, we use the text fragment “Text Fragment” as a generic example.

> **Note:**
>
> The copied text fragment must either contain no endpoints, or exactly match an existing endpoint in the text. If the text fragment contains both endpoint text and non-endpoint text, it cannot be used for Paste As.

Paste As object, with description	Resulting objects and diagrams
Class symbol Syntax check is performed on the class name.	
Object symbol Syntax check is performed on the object name.	
Text fragment The pasted text is simply a copy of the copied text.	Text Fragment
MSC instance **MSC message out** **MSC message in** The two message types place the endpoint at different ends of the message line.	
MSC diagram In the Organizer, the MSC diagram is added in the same way as for the *Add New* operation, i.e. the diagram is added as a new root diagram at the current selection. The diagram is also opened in the MSC Editor.	

Other *Edit* Commands

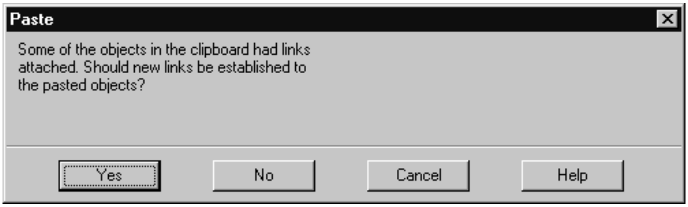
Some of the commands in the *Edit* menu in the editors are affected when operating on objects that have endpoints with connected links.

Pasting an Object

If objects with endpoints are cut or copied, the endpoints and any existing links to the objects are saved in the clipboard.

When pasting (by using the ordinary *Paste* command) an object with an endpoint, but without connected links, the endpoint is pasted together with the object without further user interaction.

When pasting objects that also have links connected to their endpoints, the following dialog appears:



Some of the objects in the clipboard had links attached. Should new links be established to the pasted objects?

Figure 146: The Paste dialog

- The *Yes* button pastes the objects and keeps the links. An object having connected links will be pasted with new links created between the pasted object and the objects the original object was linked to.
- The *No* button pastes the objects without endpoints and links. No pasted objects will have any endpoints or connected links.

Deleting an Object

If you delete an object that has links, the link information will be destroyed and cannot be restored. Therefore, when you want to cut or clear objects with links, a warning dialog will be issued where it is possible to cancel the operation.

The Link Manager

The Link Manager manages endpoints and links in a system. The Link Manager handles the link file, containing information about the endpoints and links in a system. The syntax of the link file is described in “The Link File” on page 485.

For an overview of link concepts, see “Link Concepts and Overview” on page 428. In addition, the following concepts are used in the Link Manager:

- *Entity*

  A collection of endpoints with the same type and name in the same scope is called an *entity*. The scope is defined as the file the endpoint resides in. If the file is in an Organizer module, the scope is the module.

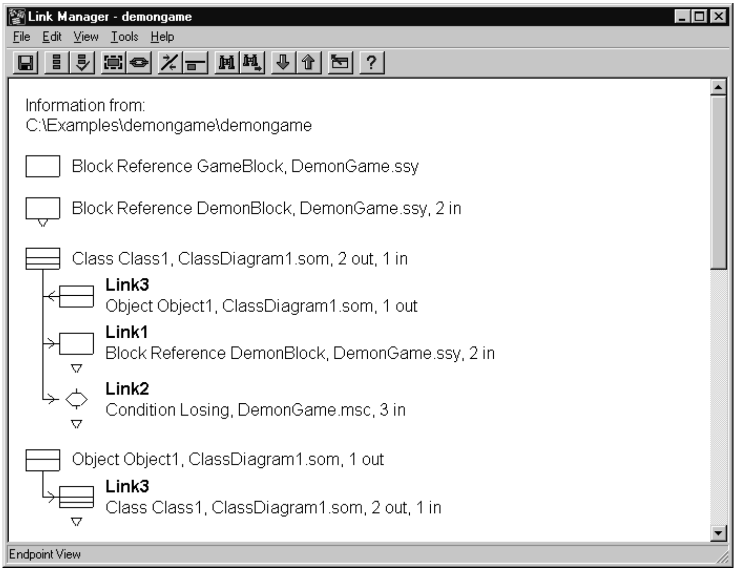
- *Cardinality*

  The number of links associated with an endpoint, i.e. the total number of links going to and from the endpoint.

Link Manager Window

The Link Manager’s window is shown in Figure 147. The window title contains the name of the loaded link file, and is appended by an asterisk ‘*’ if the link file is modified.

In the window, the endpoints in the system are presented graphically using icons. The links between the endpoints are represented as lines between them, with an arrow stating the direction of the link. The Link Manager can present different *views* of the endpoint/link information; these are described in “Presentation Views and Link Trees” on page 464.



Information from:
C:\Examples\demongame\demongame

Block Reference GameBlock, DemonGame.ssy

Block Reference DemonBlock, DemonGame.ssy, 2 in

Class Class1, ClassDiagram1.som, 2 out, 1 in

Link3
Object Object1, ClassDiagram1.som, 1 out

Link1
Block Reference DemonBlock, DemonGame.ssy, 2 in

Link2
Condition Losing, DemonGame.msc, 3 in

Object Object1, ClassDiagram1.som, 1 out

Link3
Class Class1, ClassDiagram1.som, 2 out, 1 in

Figure 147: The Link Manager window

At the top of the drawing area, the name of the current link file is presented under a “Information from” heading. If several link files are merged, they are all listed here until the next *Save* operation. If a local link file is used (see “Local Link File” on page 429), both the master link file (read only) and the local link file are listed.

If the information in the Link Manager is not yet saved, “on-line editing” will be displayed to indicate that endpoints have been created in an editor or in the Organizer.

The main part of the drawing area displays all endpoints and links as *link trees*. Every endpoint is a root node, and the associated links and endpoints are added to that root. Link trees can be collapsed, and endpoints and links can be hidden.

Below the link trees, some statistics are presented under a “Statistics” heading. The number of endpoints and links is displayed, including the number of hidden endpoints and links, as in the following example:

```
Statistics:
10 endpoints (2 not shown)
```

```
4 links (1 not shown)
```

Endpoint Icons

The Link Manager uses the same icons for endpoints as the Entity Dictionary. See “Entity Icons” on page 436 for more information.

The icons can have different layouts indicating the state of the associated endpoint:

□ **Normal**
The normal state of the icon. Information is not modified.

■ **Invalid**
An endpoint is marked invalid if, after a *Check Endpoints* operation, it is not present in the document where it was supposed to be.

▒ **Dirty**
The endpoint is modified or newly created from an editor, but the link file is not yet saved.

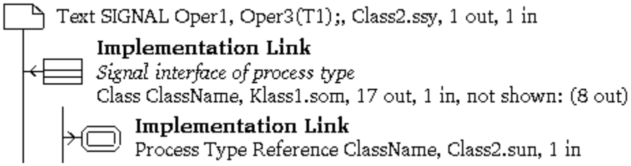
⬚ **Dashed**
The endpoint is already displayed on a higher level in the same tree, or it belongs to the *TO* group after a *Consistency Check*.

The endpoints are added as new root symbols below the last link tree as they are created. The order of the icons can be changed by using the quick buttons *Move Down* and *Move Up*.

Presentation Views and Link Trees

The Link Manager has two main methods of displaying endpoints, using an *Endpoint view* or an *Entity view*. There is also a *Consistency view*, used for presenting the results after a consistency check has been performed (see “Consistency Check” on page 476). When there is no selection in the drawing area, the name of the currently displayed view is shown in the status bar.

In Endpoint view, a link tree looks like this:



Text SIGNAL Oper1, Oper3(T1);, Class2.ssy, 1 out, 1 in

Implementation Link

Signal interface of process type

Class ClassName, Klass1.som, 17 out, 1 in, not shown: (8 out)

Implementation Link

Process Type Reference ClassName, Class2.sun, 1 in

Figure 148: Link tree in Endpoint view

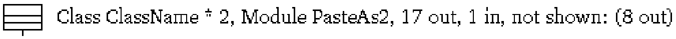
To the right of each endpoint icon, the following information identifying the endpoint is displayed (depending on the options set in *Options > Endpoint*):

- The endpoint type, i.e. the type of the endpoint object.
- The name of the endpoint, in a plain type face. For endpoints containing a name, such as diagram symbols, this name is listed. For other symbols and text fragments, the first 25 characters are shown.
- The file the endpoint resides in. The file name is shown with or without its absolute path depending on the setting in the Organizer.
- The link cardinality; the number of "out" links followed by the number of "in" links.
- The number of hidden links, if any, within parenthesis.

For each link in a link tree, the name of the link is displayed above the endpoint information, in **bold face**. The link name display can be switched on or off by the menu choice *Options > Link*.

The link comment, if it is used, is shown directly below the link name, in *italics*. The comment display can be switched on or off by the menu choice *Options > Link*.

In Entity view, all endpoints representing the same entity are collected into one symbol, and the number of endpoints represented by that entity is presented to the right of the name of the entity, preceded by an asterisk '*'. Also, instead of displaying the filename the endpoint resides in, the scope the entity resides in is displayed. The scope is either a filename or a module. An example of an endpoint in Entity view:



Class ClassName * 2, Module PasteAs2, 17 out, 1 in, not shown: (8 out)

Figure 149: An entity in Entity view

Link Manager operations on endpoints also apply to entities. If there is a difference in the behavior of a menu choice depending on the view, this will be pointed out in the descriptions of the operations.

Double-Clicks

Double-clicking on an icon invokes the menu choice *Show in Editor*. In Entity view, if the selected entity corresponds to several endpoints, they will be selected one at a time for each double-click.

Menu Bar

This section describes the menu bar of the Link Manager window and all the available menu choices.

The menu bar contains the following menus:

- *File Menu*
- *Edit Menu*
- *View Menu*
- *Tools Menu*
- *Help Menu*
  (see "Help Menu" on page 15 in chapter 1, *User Interface and Basic Operations*).

File Menu

The *File* menu contains the following menu choices:

- *New*
- *Open*
- *Merge*
- *Save*
- *Save As*
- *Print*
- *Close*

The menu choices are described in "File Menu" on page 8 in chapter 1, *User Interface and Basic Operations*, except *Print*, which is described in "The Print Dialogs in the SDL Suite and in the Organizer" on page 308 in chapter 5, *Printing Documents and Diagrams*, and *Merge*, which is described below.

Merge

This menu choice opens an existing link file, and merges the contents of that file with the information already in the Link Manager. It works in a similar way to *Open*, but keeps the current endpoint and link information.

If two links are equal (i.e. they have the same source and destination endpoints and the same name) but they have different link comments, the new comment will consist of the old comments separated by a newline character.

Edit Menu

The *Edit* menu contains the following menu choices:

- *Highlight Endpoint*
- *Replace Endpoint*
- *Create Link*
- *Link Details*
- *Clear Link*.

Highlight Endpoint

This menu choice highlights an endpoint. Highlighting an endpoint is the first step to replace an endpoint or create a link. The highlighting is presented as a frame around the highlighted endpoint.

The first time this menu choice is used, the selected endpoint will be highlighted. The second time this menu choice is used for the same endpoint the highlighting will be removed. There is at most one highlighted endpoint. If another endpoint already was highlighted, the highlighting is moved to the selected endpoint.

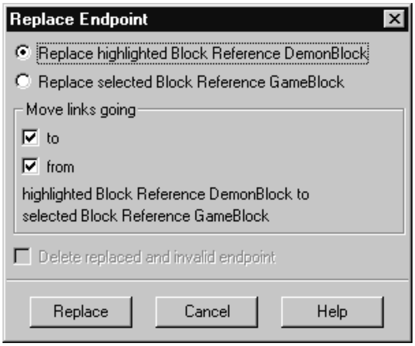
Replace Endpoint

This menu choice replaces an endpoint with another endpoint. This operation is useful if an endpoint has become Invalid and the user has found a replacement endpoint that all links should be moved to.

One endpoint is defined with the *Highlight Endpoint* menu choice, the other endpoint is defined by the selection.

All links going to or from the replaced endpoint will be updated to go to or from the other endpoint instead. If the replaced endpoint was invalid, the user is given the option to delete the replaced endpoint.

The following dialog appears:



● Replace highlighted Block Reference DemonBlock

○ Replace selected Block Reference GameBlock

Move links going

☑ to

☑ from

highlighted Block Reference DemonBlock to selected Block Reference GameBlock

□ Delete replaced and invalid endpoint

Figure 150: The Replace Endpoint dialog

- *Replace highlighted* `<endpoint>`
- *Replace selected* `<endpoint>`

  Depending on the setting of the radio button, either the highlighted or the selected endpoint will be replaced.

- *Move links going to/from*

  These options are used to select if links going to the replaced endpoint, or links going from the replaced endpoint, will be moved.

- *Delete replaced and invalid endpoint*

  If the endpoint to be replaced is invalid, it can optionally be deleted. If any links going to the deleted endpoint are not moved, they will also be deleted.

Create Link

This menu choice creates a link between the highlighted endpoint and the selected endpoint.

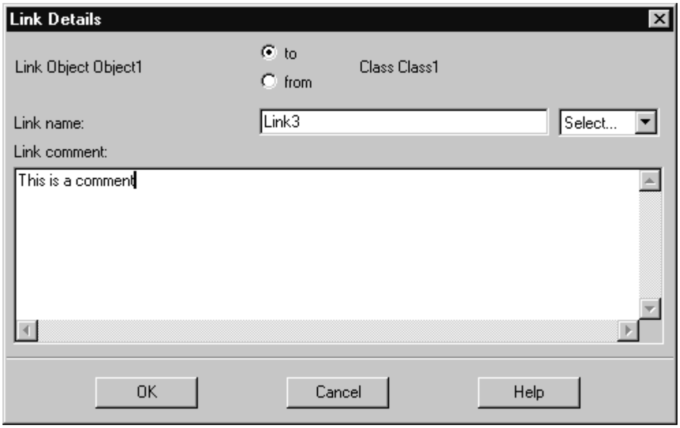
One endpoint is defined with the *Highlight Endpoint* menu choice, the other is defined by the selection.

The Create Link dialog appears, see Figure 139 on page 443.

Link Details

This menu choice displays information about the link above the selected endpoint; the name, the comment, and the direction of the link. All these attributes can be edited.

The following dialog appears:



Link Details

Link Object Object1 ● to ○ from Class Class1

Link name: Link3

Link comment:

This is a comment

Figure 151: The Link Details dialog

The dialog works in the same way as the Create Link dialog, see Figure 139 on page 443.

Clear Link

This menu choice clears (deletes) the link above the selected endpoint. Only the link will be cleared, not the associated endpoints. You will be asked to confirm or cancel the deletion.

View Menu

The *View* menu contains the following menu choices:

- *Expand*
- *Expand Substructure*
- *Collapse*
- *Options > Window*
- *Options > Link*
- *Options > Endpoint*
- *Filter*
- *Set Scale*.

Expand

This menu choice expands the endpoint structure tree one level down for the selected endpoint. If any endpoints one level down are hidden, they will still be hidden after this operation. (Use the *Filter* menu choice to show or hide endpoints).

The menu choice is dimmed if:

- No endpoint is selected
- The selected icon is a leaf (no children icons)
- The selected icon is already expanded

Expand Substructure

This menu choice expands the endpoint structure tree the whole way down for the selected endpoint. If there is no selection, all endpoint trees will be expanded.

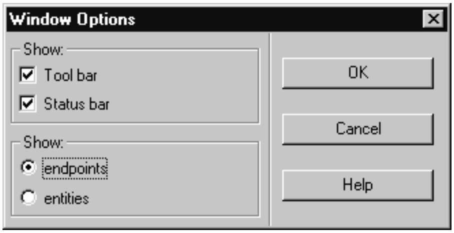
Collapse

This menu choice collapses the selected endpoint, i.e. the sub symbols are not shown after this operation. A collapsed endpoint has a small triangle drawn below the icon to indicate that it is collapsed. If there is no selection, everything will be collapsed.

Options > Window

This menu choice sets options for controlling the appearance of the Link Manager window.

The following dialog appears:



Window Options

Show:

☑ Tool bar

☑ Status bar

Show:

● endpoints

○ entities

Figure 152: The Window Options dialog

- *Show: Tool Bar*
- *Show: Status Bar*

  These options control whether the tool bar and the status bar should be displayed or not.

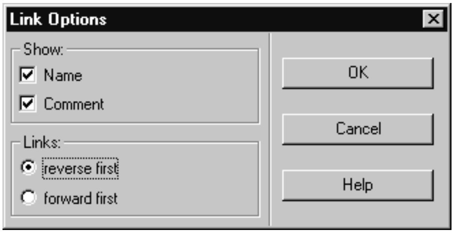
- *Show: endpoints/entities*

  By using this radio button, Endpoint or Entity view is selected (see “Presentation Views and Link Trees” on page 464).

Options > Link

This menu choice sets options for controlling the appearance of links in the drawing area.

The following dialog appears:



Link Options

Show:

☑ Name

☑ Comment

Links:

● reverse first

○ forward first

Figure 153: The Link Options dialog

- *Show: Name*

  Show/hide the name of all links.

- *Show: Comment*

  Show/hide the comment for all links.

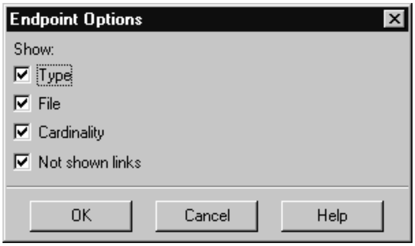
- *Links: reverse first/forward first*

  This setting controls whether links going to a root endpoint (*reverse first*) or links going from a root endpoint (*forward first*) will be displayed first in the link trees.

Options > Endpoint

This menu choice sets options for controlling the appearance of endpoints in the drawing area.

The following dialog appears:



Endpoint Options

Show:

☑ Type

☑ File

☑ Cardinality

☑ Not shown links

Figure 154: The Endpoint Options dialog

- *Show: Type*

  Show/hide the type of the endpoints.

- *Show: File*

  Show/hide the file name (or module) of the endpoints.

- *Show: Cardinality*

  Show/hide the cardinality, i.e. the number of links going to and from an endpoint.

- *Show: Not shown links*

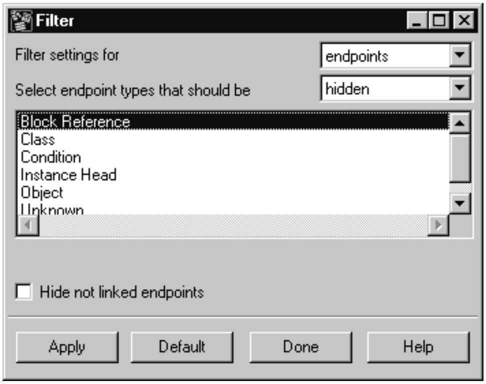
  Show/hide the number of hidden links going to and from an endpoint.

Filter

This menu choice is used for filtering out endpoints and/or links which will not be shown. The filter is set in a modeless dialog, i.e. the Link Manager continues working without waiting for the dialog to be closed.

If an endpoint is hidden, all links associated to it will be hidden. If a link is hidden, the endpoints associated to it will still be visible.

The following dialog appears:



Filter settings for endpoints

Select endpoint types that should be hidden

Block Reference
Class
Condition
Instance Head
Object
Unknown

□ Hide not linked endpoints

Figure 155: The Filter dialog

- *Filter settings for links/endpoints/documents*

  By using this option menu, filtering can be done on endpoint types, link names, and document file names. All filters are active simultaneously, i.e. for the filter to take effect, all three filter conditions must be true.

  The multiple-selection list in the dialog contains all link names, endpoint types or file names in the loaded link file, depending on the current setting of the option menu. By default, nothing is selected.

- Select <type of filter> that should be hidden/shown

  Depending on this option menu choice, the selected links/endpoints/documents will either be hidden or shown.

- *Hide not linked endpoints*

  If this option is set, all endpoints which are not linked will be hidden. This option is dimmed if filtering is not done on endpoint types.

- Pressing *Default* will set all the lists to their default values, but the filter is not applied until *Apply* is pressed.

Set Scale

Issues a dialog where the scale may be set.

Tools Menu

The *Tools* menu contains the following menu choices:

- *Show Organizer*
  (see "Show Organizer" on page 15 in chapter 1, *User Interface and Basic Operations*)

- *Search*
- *Search Again*
- *Consistency Check*
- *Check Endpoints*
- *Show in Editor*.

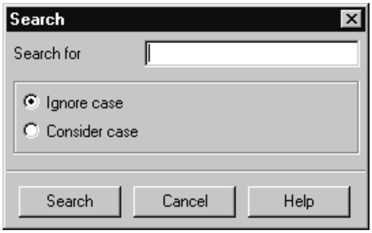
Search

This menu choice searches for a text string in endpoints or links.

The searching is based on ASCII character matching. All texts related to the endpoints and links are searched, i.e. endpoint types and names, link names and comments.

The search will start from the selected endpoint, or from the first endpoint if nothing is selected.

The following dialog appears:



● Ignore case
○ Consider case

Figure 156: The Search dialog

- *Search for*

  The text string to search for. If a search already has been done, the previous search text is used by default.

- *Ignore Case/Consider case*

  Depending on the radio button setting, the search will either be case sensitive or not.

Search Again

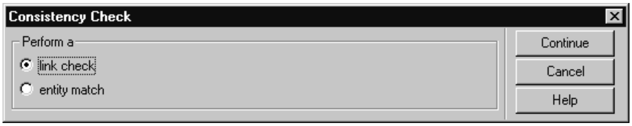
This menu choice searches again for the same text string as the last performed search.

The menu choice is dimmed if a search has not yet been done.

Consistency Check

This menu choice is used for checking the consistency between a group of documents (the *FROM* group) and another group of documents (the *TO* group).

In Entity view, there are two types of consistency checks to choose from. The following dialog appears:



Perform a
● link check
○ entity match

Figure 157: The Link Check/Entity Match dialog

- *Link check*

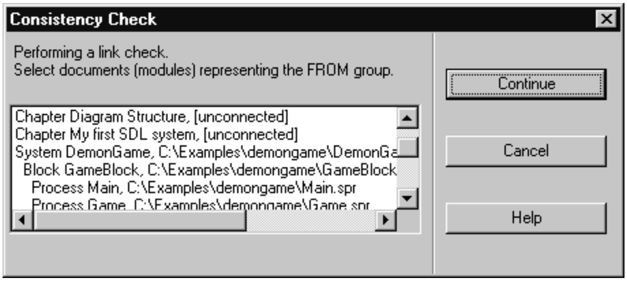
  Check that all endpoints/entities in the *FROM* group are linked with at least one endpoint/entity in the *TO* group.

- *Entity match*

  Check that all entities (not endpoints) in the *FROM* group has matching entities (not endpoints) in the *TO* group.

The above dialog is not opened in Endpoint view, in which case a link check always is performed.

First, the documents in the *FROM* group must be selected. The following dialog appears:



Performing a link check.
Select documents (modules) representing the FROM group.

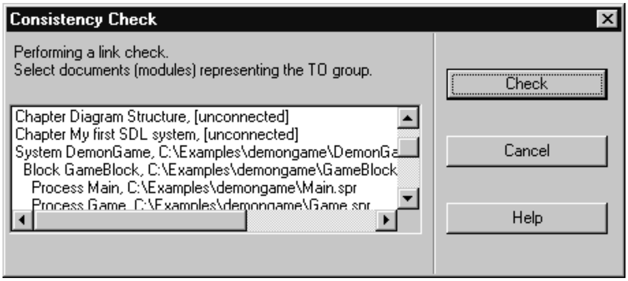
Chapter Diagram Structure, [unconnected]
Chapter My first SDL system, [unconnected]
System DemonGame, C:\Examples\demongame\DemonGa
Block GameBlock, C:\Examples\demongame\GameBlock
Process Main, C:\Examples\demongame\Main.spr
Process Game, C:\Examples\demongame\Game.spr

Figure 158: Selecting the FROM group

In the list of Organizer documents and modules, one or several documents must be selected. Selecting/deselecting a module will select/deselect all the documents in that module. Selecting/deselecting an SDL system will select/deselect all documents in that system. Individual documents in the module/system can then be selected/deselected without affecting the other documents.

When all *FROM* documents are selected, the *Continue* button is used to close the dialog and continue to the next dialog.

Then, the documents in the *TO* group must be selected. The following dialog appears:



Performing a link check.
Select documents (modules) representing the TO group.

Chapter Diagram Structure, [unconnected]
Chapter My first SDL system, [unconnected]
System DemonGame, C:\Examples\demongame\DemonGa
Block GameBlock, C:\Examples\demongame\GameBlock
Process Main, C:\Examples\demongame\Main.spr
Process Game, C:\Examples\demongame\Game.spr

Figure 159: Selecting the TO group

The list of Organizer documents and modules works in the same way as when selecting the *FROM* documents. When all *TO* documents are selected, the *Check* button is used to close the dialog and start the consistency check operation.

The result of the consistency check is presented as a special view in the drawing area. This *Consistency view* only shows endpoints/entities from the two defined groups of documents. Endpoints/entities from the *FROM* group are shown in the normal way, and endpoints/entities from the *TO* group are shown as Dashed symbols.

The Consistency view is only showing links going from the *FROM* group of entities/endpoints to the *TO* group. After a link check, the links shown are the “real” links, as defined by the user. After an entity match, the links shown are only temporary links created by the Link Manager to indicate matching entities. The link name for such links are “Matching” and the link comment is “(Temporary link)”.

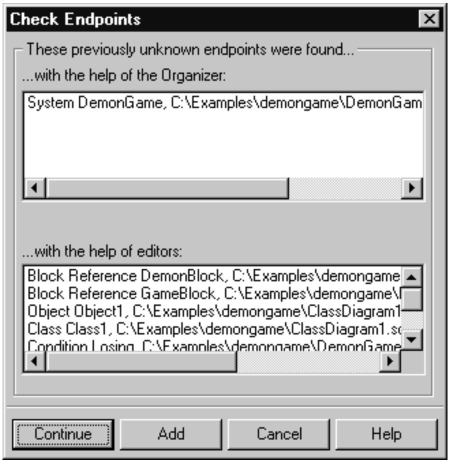
By selecting Endpoint or Entity view in *Options > Window*, the view will return to the selected normal view. By pressing the quick button *Show Endpoints or Entities*, the view will return to the previously used view.

Check Endpoints

This menu choice checks if there are endpoints in the Organizer or in the editors that do not exist in the Link Manager, or if there are invalid endpoints in the Link Manager. This menu choice could be used to remove any inconsistencies between the document endpoints in the system and the information in the Link Manager.

The information in the saved files is used for the checking, so if there are unsaved changes in an editor, these will not be taken into account in the checking. If there are any documents in the Organizer which have not been saved, the following dialog appears:

First, the Organizer and all documents in the system are checked. The following dialog appears:



Check Endpoints

These previously unknown endpoints were found...

...with the help of the Organizer:

System DemonGame, C:\Examples\demongame\DemonGam

...with the help of editors:

Block Reference DemonBlock, C:\Examples\demongame
Block Reference GameBlock, C:\Examples\demongame\
Object Object1, C:\Examples\demongame\ClassDiagram1
Class Class1, C:\Examples\demongame\ClassDiagram1.s
Condition Losing, C:\Examples\demongame\DemonGame

Figure 160: The first Check Endpoints dialog

In the upper multiple selection list, all endpoints that were found in the Organizer, but do not exist in the Link Manager, are listed. In the lower multiple selection list, all endpoints that were found in the documents belonging to the system, but do not exist in the Link Manager, are listed. It is possible to select one or more of the endpoints in the lists, with the purpose of adding them to the Link Manager.

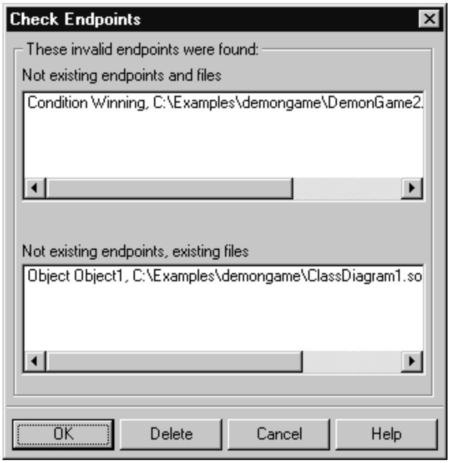
- *Continue*

  Closes the dialog and continues to the next dialog. Any selected endpoints are **not** added to the Link Manager.

- *Add*

  Adds the selected endpoints to the Link Manager. The dialog is not closed until the *Continue* button is pressed.

Then, the endpoints in the Link Manager are checked. If any non-existing endpoints are found, they will be marked as Invalid. The following dialog appears:



Check Endpoints
These invalid endpoints were found:
Not existing endpoints and files
Not existing endpoints, existing files
OK
Delete
Cancel
Help

Condition Winning, C:\Examples\demongame\DemonGame2.

Object Object1, C:\Examples\demongame\ClassDiagram1.so

Figure 161: The second Check Endpoints dialog

In the upper multiple selection list, all Link Manager endpoints which reside in files that have been deleted are listed. In the lower multiple selection list, all Link Manager endpoints that no longer are present in the files they are supposed to be in are listed. It is possible to select one or more of the endpoints in the lists, with the purpose of deleting them from the Link Manager.

- *OK*

  Closes the dialog and returns to the main window. Any selected endpoints are **not** deleted from the Link Manager.

- *Delete*

  Deletes the selected endpoints from the Link Manager. The dialog is not closed until the *OK* button is pressed.

Show in Editor

This menu choice will show the symbol which corresponds to the selected endpoint in an editor.

In Entity view, each entity can represent more than one endpoint. In that case, the menu choice will be replaced by *Show 1 in Editor*, *Show 2 in Editor*, etc.

If there are more than nine endpoints, the menu choice *Show in Editor* will invoke the following dialog, where it is possible to select the appropriate endpoint:

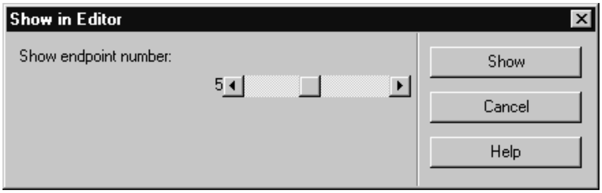


Figure 162: The Show in Editor dialog

Popup Menus

There are two popup menus available in the Link Manager:

On Endpoints

Highlight Endpoint	“Highlight Endpoint” on page 467
Replace Endpoint	“Replace Endpoint” on page 467
Create Link	“Create Link” on page 468
Link Details	“Link Details” on page 469
Clear Link	“Clear Link” on page 469
Expand	“Expand” on page 470
Expand Substructure	“Expand Substructure” on page 470
Collapse	“Collapse” on page 470
Show in Editor	“Show in Editor” on page 480

On the Background

Consistency Check	“Consistency Check” on page 476
Check Endpoints	“Check Endpoints” on page 478
Expand Substructure	“Expand Substructure” on page 470
Collapse	“Collapse” on page 470
Options > Window	“Options > Window” on page 471
Options > Link	“Options > Link” on page 472
Options > Endpoint	“Options > Endpoint” on page 473
Filter	“Filter” on page 474
Search	“Search” on page 475
Search Again	“Search Again” on page 476
Show Organizer	“Show Organizer” on page 15 in chapter 1, *User Interface and Basic Operations*

Keyboard Accelerators

In addition to the standard keyboard accelerators, described in “Keyboard Accelerators” on page 35 in chapter 1, *User Interface and Basic Operations*, the following accelerators can be used in the Link Manager:

Accelerator	**Reference to corresponding command or quick button**
`Ctrl+E`	“Show in Editor” on page 480
`Ctrl+1`	“Show Organizer” on page 15 in chapter 1, *User Interface and Basic Operations*
`Del`	“Clear Link” on page 469
`Arrow up`	Select the endpoint one step up (move the selection)
`Shift+arrow up`	“Move Up” on page 484
`Arrow down`	Select the endpoint one step down (move the selection)
`Shift+arrow down`	“Move Down” on page 484

Quick Buttons

Except for some of the general Telelogic Tau quick buttons (see “General Quick-Buttons” on page 24 in chapter 1, *User Interface and Basic Operations*) the following quick buttons are included the Link Manager.

Show Endpoints or Entities
Switches between the Endpoint and the Entity views; see “Options > Window” on page 471.

Consistency Check
Performs a consistency check operation; see “Consistency Check” on page 476.

Highlight Endpoint
Highlights the selected endpoint; see “Highlight Endpoint” on page 467.

Create Link
Creates a link between the highlighted and the selected endpoint; see “Create Link” on page 468.

Switch Link Direction
Changes the order of the links going to or from the (root) endpoint; see “Options > Link” on page 472.

Show or Hide Unused Endpoints
Toggles between showing and hiding endpoints that are not linked; see “Filter” on page 474.

Move Down
Moves the selected (root) endpoint one step down in the Link Manager view.

Move Up
Moves the selected (root) endpoint one step up in the Link Manager view.

The Link File

The Link Manager maintains a link file that contains a list of all endpoints and links in the system. The link file is a line-oriented, human-readable text file, with the default file name extension `.sli`.

The file has the following format:

```
<link file> ::= <endpoints> <links> $

<endpoints> ::= [ENDPOINTS] <endpoint>*
<endpoint> ::= <endpoint id> <endpoint format>
<endpoint id> ::= <integer>
```

A unique integer identifying the endpoint in the link file.

```
<endpoint format> ::= '(' <format> , <file name>
                      (, <anchor> | $) ')' <name>
                      <type>
<format> ::= SDL | OM | MSC | TEXT | WORD

<file name> ::= <string>
```

Name of the document file.

```
<anchor> ::= <string>
```

A unique string identifying the endpoint in the document. If the endpoint refers to the whole file, i.e. the endpoint is created in the Organizer, the anchor is set to an empty string (“”).

```
<name> ::= <quoted string>
```

The name of the endpoint, in quotes.

```
<type> ::= <integer>
```

Type of document.

```
<links> ::= [LINKS] <link>*
<link> ::= <endpoint id> <endpoint id> <link name>
           <link comment>
<link name> ::= <quoted string>
```

The name of the link, in quotes.

```
<link comment> ::= <quoted string>
```

The link comment, in quotes.