Chapter

48

The SDL Coverage Viewer

The Coverage Viewer shows the coverage of a simulation or validation in the terms of executed transitions or symbols in the system. The information used by the Coverage Viewer can be stored in a coverage file with the file extension `.cov`.

Coverage files can be generated by the SDL Simulator and the SDL Validator.

This chapter contains a reference manual to the Coverage Viewer; the functionality it provides, its menus, windows and symbols.

Coverage Viewer Windows

The Coverage Viewer has two windows, the Main window and the Coverage Details window. The Main window graphically shows the simulation or validation coverage of transitions or symbols in a tree corresponding to the system structure. The Coverage Details window shows a more detailed coverage chart for a node in the tree.

The Main window is opened when the Coverage Viewer is started, whereas the Coverage Details window is not opened initially. The general characteristics of these windows are described in chapter 1, *User Interface and Basic Operations*.

The Main Window

The Main window shows a graphical tree representing the diagram structure of the simulated or validated system. The tree can either present *Transition Coverage* or *Symbol Coverage*; the mode is controlled by a user option. When the Coverage Viewer first opens a coverage file, the preference *ShowTransitions* is used to determine the default mode.

At the top of the drawing area, above the root of the tree, is a text identifying the type of coverage tree (transition/coverage) and the name of the current coverage file.

In the tree, the different SDL diagram types use the same icons as in the Organizer's main window. For an explanation of all other icons, see "SDL Icons" on page 2018 in chapter 47, *The SDL Index Viewer*.

Transition Coverage

When the tree shows transition coverage, the lowest level in the tree consists of transitions, represented by a small SDL input symbol. Both states and transitions are visible below the process and procedure diagrams in the tree structure. The start transitions are treated as all other transitions, even though they are represented in the tree by an SDL start symbol.

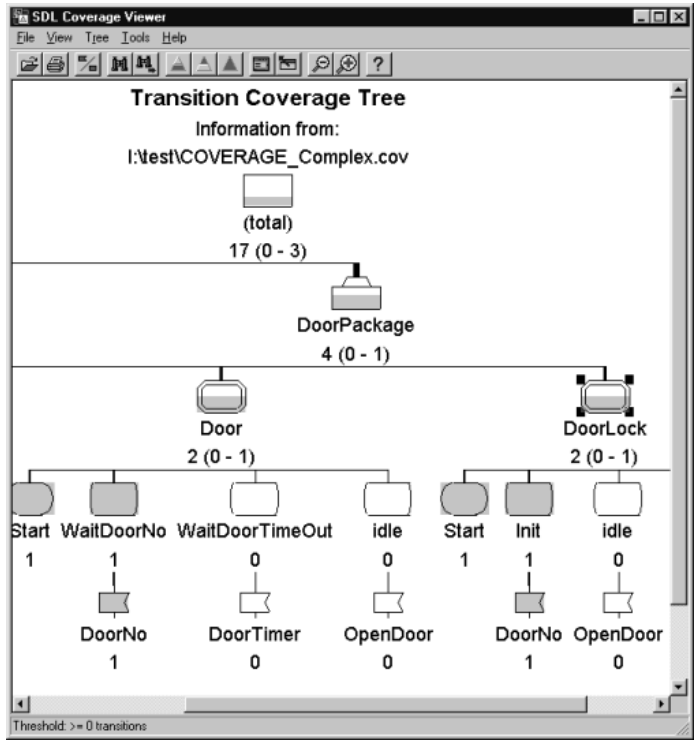

Figure 443: Transition coverage in the Main window

Symbol Coverage

When the tree shows symbol coverage, the lowest level in the tree consists of symbols corresponding to SDL symbols found in flow diagrams.

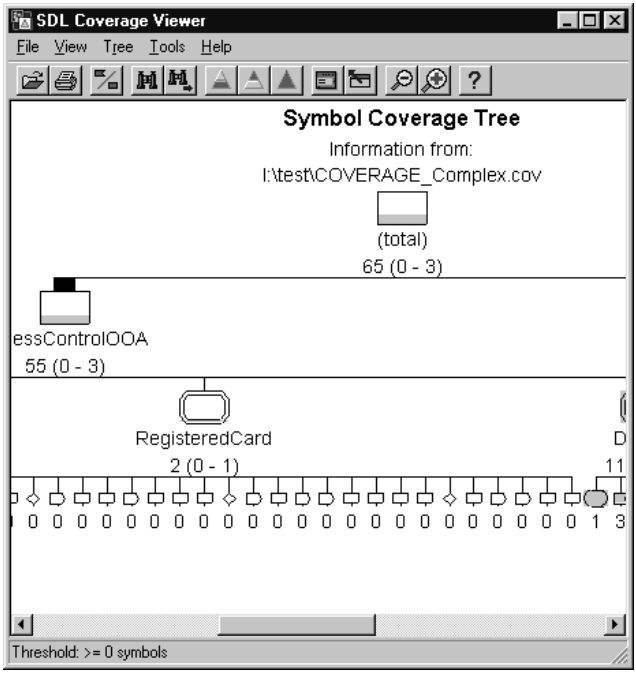

Figure 444: Symbol coverage in the Main window

Nodes

Each node in the tree consists of three parts:

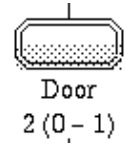

Figure 445: A coverage node

- A graphical symbol indicating the type of node, either:
  - In SDL systems containing packages, an extra root node named "(total)" is introduced, showing the grand total for the system and all packages
  - An SDL diagram (for instance, Figure 445 shows a process type symbol)
  - An SDL state
  - A transition (start transition or input of signal/timer)
  - Any symbol that can be found in SDL flow diagrams

  The graphical notation uses the same symbols as in SDL, where applicable. See also "SDL Icons" on page 2018 in chapter 47, *The SDL Index Viewer*.
- The name of the node is presented as text below the symbol (in Figure 445, the name of the process type is "Door"). An exception to this is the symbols at the lowest level in a symbol coverage tree. These symbols are shown without a name.
- The number of executed transitions/symbols associated with the node is presented below the name. For symbols above the lowest level of the tree, a range is also shown indicating the number of times the least and most executed transition/symbol below the node

has been executed. The process type symbol in Figure 445 reads "2 (0 - 1)" which means that:

– Two transitions/symbols have been executed.

– The least frequently executed transition / symbol in process type Door has been executed zero times.

– The most frequently executed transition / symbol in process type Door has been executed once.

Line Thickness

The number of executed transitions/symbols shown below the node symbol also controls the thickness of the vertical line connecting the node with its parent node.

The line thickness thus gives a visual clue about how much the different branches of the tree have been executed, expressed as a relative number. The thicker the line, the more the tree branch has been executed.

Filling Level

In each node symbol, the number of transitions/symbols that have been executed at least once in relation to the total number of transitions/symbols in that node is also displayed. This is done by filling the node symbol with a gray pattern, showing the percentage level (number of executed divided by total number).

The higher the filling level, the more transitions/symbols have been executed. Figure 445 for instance shows that 50% of the total number of transitions/symbols have been executed.

Dashed Nodes

The visibility condition determines if nodes should be shown or not. A node that should not be shown according to the visibility condition can be visible anyway because a child node is shown. To indicate that a visible node does not match the visibility condition, the node is drawn with a dashed line.

The Visibility Condition

When the Coverage Viewer first opens a coverage file, every node in the coverage tree is shown. You can hide and show nodes in two ways, either via the expand/collapse mechanism (see "View Menu" on page 2042), or via the visibility condition.

By using the visibility condition, you can control which nodes should be visible or not. Only those nodes that meet the visibility condition are shown in the tree, and you cannot use the expand mechanism to see nodes that do not meet the visibility condition.

The visibility condition is a threshold value for the number of times a transition/symbol is executed. It is specified with the *Set Visibility* menu choice in the *Tree* menu (see "Set Visibility" on page 2044). It can also be changed by quick buttons, as well as the *Increase Tree* and *Decrease Tree* menu choices in the *Tree* menu.

A node in a fully expanded tree is visible either if:

- The number of executed transitions/symbols associated with the node meets the visibility condition.
- At least one of the underlying nodes is visible.

The symbol of a node that meets the second condition but not the first one becomes dashed to indicate that the node itself does not meet the visibility condition.

Single and Double Clicks

When you select a node in the main window, the Coverage Details window is updated and displays the coverage chart for the selected node. The Coverage Details window must be opened by the *Show Details* menu choice in the *Tools* menu.

To double-click on a symbol in the main window opens an SDL Editor with a diagram that corresponds to the selected symbol. See "Show in Editor" on page 2047 for more information.

Quick Buttons

The following quick buttons are special to the Main window. The general quick buttons are described in "General Quick-Buttons" on page 24 in chapter 1, *User Interface and Basic Operations*.

Coverage Type
Switches between a transition coverage tree and a symbol coverage tree in the Main window.

Show Bottom
Changes the appearance of the coverage tree to show only those transitions/symbols that have been executed the **least** number of times, i.e. having a number of executions exactly equal to the **lowest** number of available executions. This command changes the visibility condition.

Show Top
Changes the appearance of the coverage tree to show only those transitions/symbols that have been executed the **most** number of times, i.e. having a number of executions exactly equal to the **highest** number of available executions. This command changes the visibility condition.

Show Whole Tree
Changes the appearance of the coverage tree to show all transitions/symbols. The visibility condition is reset to zero or more (>=0).

Show Details Window
Pops up (opens/raises) the Coverage Details window.

The Menu Bar

File Menu

The *File* menu contains the following menu choices:

- *Open*
  (See "Open" on page 9 in chapter 1, *User Interface and Basic Operations*.)
- *Open Directory*
- *Merge*
- *Save*
  (See "Save" on page 11 in chapter 1, *User Interface and Basic Operations*.)
- *Print*
  (See *"Printing from the SDL Suite" on page 307 in chapter 5, Printing Documents and Diagrams*.)
- *Exit*
  (See "Exit" on page 15 in chapter 1, *User Interface and Basic Operations*.)

Open Directory

This menu choice is used to merge information from all coverage files (`*.cov`) in one directory.

> **Note:**
> It is only possible to merge coverage files created from the same SDL system, i.e. the *Open Directory* operation will fail if there are coverage files from different SDL systems in the same directory.

A directory selection dialog is opened. The first coverage file in the specified directory is opened, and all other coverage files in the specified directory are merged. The resulting coverage information is presented in the main coverage window.

Merge

Reads an additional coverage file about the same system and merges the coverage information in it with the current coverage information. A File Selection Dialog is opened with the file filter set to `*.cov`. The contents of the main window is augmented by the additional information read from the selected file.

It is not possible to merge coverage files with another system.

View Menu

The View menu contains the following menu choices:

- *Expand*
- *Expand Substructure*
- *Expand All*
- *Collapse*
- *Window Options*
- *Set Scale*

Expand

Expands the selected node one level down.

Expand Substructure

Expands the selected node as much as possible.

Expand All

Expands all nodes as much as possible.

Collapse

Collapses the selected node, i.e. hides all child objects. This menu choice is named *Collapse All* if no node is selected. Invoking the *Collapse All* menu choice collapses the top node.

Window Options

Sets options for which parts of the Main window to show. The dialog controls whether to show the tool bar and the status bar.

Set Scale

Issues a dialog where the scale for the main window may be set.

Tree Menu

The Tree menu contains the following menu choices:

- *Tree Options*
- *Symbol Options*
- *Line Options*
- *Increase Tree*
- *Decrease Tree*
- *Set Visibility*

Tree Options

Sets options for which type of coverage tree to show in the main window. The dialog controls whether to show either:

– *Transition Coverage*
– *Symbol Coverage*

Symbol Options

Sets options for how to show execution numbers for the nodes in the coverage tree. The dialog controls whether to show the numbers for

– *Every node*,
– the *Bottom nodes* only, or
– *Do not show numbers* at all.

Line Options

Sets options for controlling the line thickness of the nodes in the coverage tree.

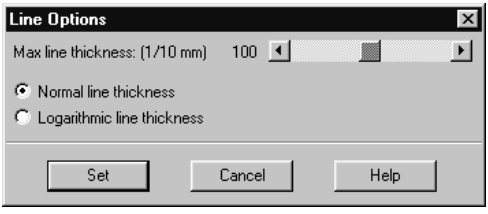

Figure 446: The Line Options dialog

- *Normal line thickness*
- *Logarithmic line thickness*

  The dialog controls whether to show *Normal line thickness* or *Logarithmic line thickness*, i.e. the thickness is proportional either to the executed number of transitions/symbols, or to the logarithm of the same number.

- *Max line thickness*

  With a slide bar, you may also specify the *Max line thickness*, measured in 1/10 mm. The possible range of values is 1–200. The default is 60, which is the thickness of the line connecting the top node of the tree.

Increase Tree

Shows more of the coverage tree by calculating a *visibility threshold* (see "The Visibility Condition" on page 2039) that makes at least one more symbol become visible.

Decrease Tree

Shows less of the coverage tree by calculating a *visibility threshold* (see "The Visibility Condition" on page 2039) that makes at least one more symbol become hidden.

Set Visibility

Sets options to control the visibility condition of the coverage tree (see "The Visibility Condition" on page 2039).

Figure 447: The Set Visibility dialog

The dialog controls:

- *Threshold*

  The value which may be set with the slide bar,

- *Show symbols executed >= threshold*
- *Show symbols executed <= threshold*

  The option whether to make nodes visible that are executed more than or less than the threshold value.

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*
- *Show Coverage*
- *Show in Editor*
- *Show Details*

Search

Searches for a visible node name in the coverage tree shown in the Main window.

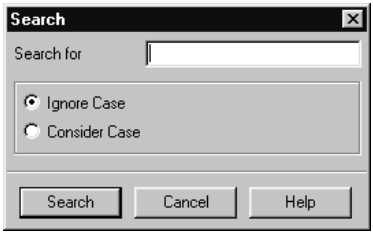

Figure 448: The Search dialog

- *Search for*

  Specifies the text string to search for. As a special case, a GR Reference obtained from for instance an editor may also be specified.

- *Ignore Case, Consider Case*

  These options toggles between a case insensitive and a case sensitive search.

- *Search*

  Starts the search and closes the dialog. The first symbol containing the text is selected. The search starts from the selected symbol, if any, or from the first symbol in the tree.

If the search reaches the end of the tree, you are asked whether to continue the search from the first node.

If the text cannot be found among the visible information, you are informed in a confirmation dialog.

Search Again

Searches again for the same text as in the latest search. The behavior is the same as described in "Search" on page 2045 above.

Show Coverage

Opens an SDL Editor for all the transitions/symbols that meet a certain threshold condition in the tree below the selected symbol. The diagram symbols corresponding to the transitions/symbols become selected in the SDL Editor.

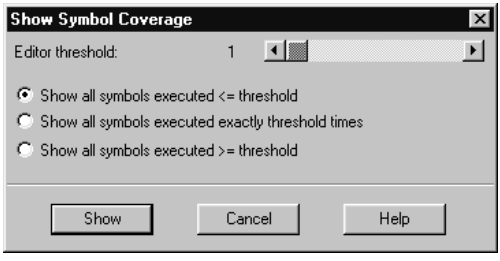

Figure 449: The Show Coverage dialog

The dialog controls the *Editor threshold* value with a slide bar, as well as whether to show transitions/symbols that are executed, either:

- less than
- equal to
- more than

the threshold value.

The *Show* button displays all diagram pages containing transitions or symbols that meet the threshold condition, one page at a time, with a confirmation dialog between each page.

Transitions (represented by the input symbol) or symbols matching the threshold condition are selected and colored with a temporary background color. The temporary background color can be removed with SDL editor > View > Temporary Colors > Remove. The temporary background color is also removed when the diagram is unloaded from the editor.

There is a *No Dialog* button in the confirmation dialog that can be used to avoid displaying the confirmation dialog for each page with symbols to show.

Note:

The editor threshold condition specified in this dialog does not affect the visibility condition. It only controls which transitions/symbols to show in an SDL Editor.

Show in Editor

Opens an SDL Editor with a diagram that corresponds to the selected symbol. If the selected symbol is located in a process or procedure diagram, the corresponding diagram symbol becomes selected in the diagram. Only applicable on transition/symbol icons at the lowest level in the tree, including start states.

Show Details

Opens or raises the Coverage Details window, showing a coverage chart for the selected node.

Popup Menus

The following tables lists the menu choices in the main window popup menus and a reference to the corresponding menu choice in the menu bar, or the corresponding quick button.

On the Main Window Background

Show Bottom	"Show Bottom" on page 2040.
Show Top	"Show Top" on page 2040.
Show Whole Tree	"Show Whole Tree" on page 2040.
Show Details	"Show Details" on page 2047.
Expand All	"Expand All" on page 2042.
Collapse All	Collapses the whole tree, i.e. only the top node becomes visible.

On a Node in the Coverage Tree

Show in Editor	"Show in Editor" on page 2047.
Expand	"Expand" on page 2042.
Expand Substructure	"Expand Substructure" on page 2042.
Collapse	"Collapse" on page 2042.

Keyboard Accelerators

Apart from the general keyboard accelerators, the following accelerator can be used in the main window:

Accelerator	Reference to corresponding command
`Ctrl+E`	"Show in Editor" on page 2047

Coverage Details Window

The Coverage Details window presents more detailed coverage information for the node selected in the Main window. It contains a coverage chart for transitions or symbols, depending on what type of tree is shown in the main window. Above the chart is a text identifying:

- The type of coverage chart
- The type and name of the node
- The total number of executed transitions/symbols.
- The number of covered transitions/symbols.
- The number of not covered transitions/symbols.

The Coverage Details window is updated when the selection in the Main window is changed. The Coverage Details window is updated to show the coverage chart for the node selected in the Main window.

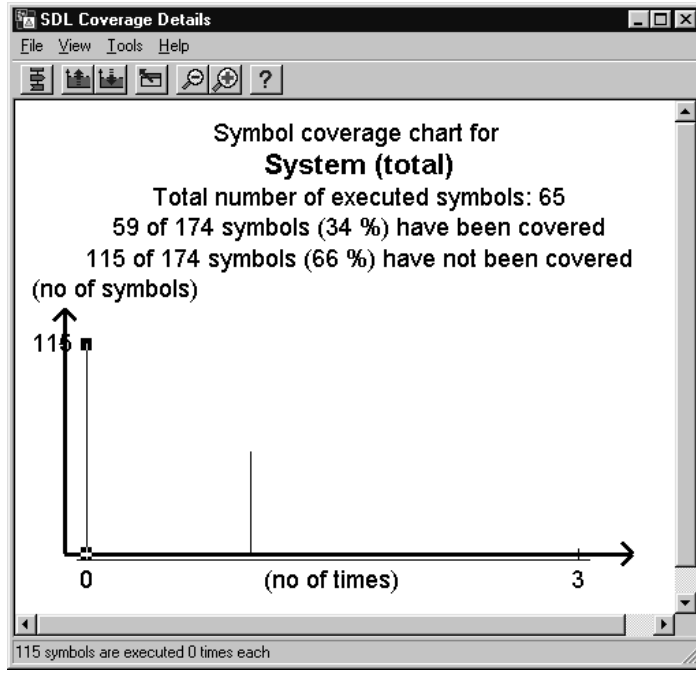

Figure 450: Coverage Details window

The Coverage Chart

The coverage chart shows how many transitions/symbols in the node that have been executed a certain number of times:

- The horizontal axis denotes the number of times a transition/symbol is executed; the range of the axis is the same as the range shown for the node in the Main window.
- The vertical axis denotes the number of transitions/symbols that has been executed a specific number of times; the range of the axis cannot generally be determined from the values shown for the node in the Main window.

For each value along the horizontal axis (no of times), a vertical bar shows how many transitions/symbols have been executed that specific number of times. The vertical axis scale is adjusted to include the highest vertical bar, but this can be changed by using the *Chart Options* menu choice in the *View* menu (see "Chart Options" on page 2052), or the quick buttons.

The left most bar is automatically selected when a new coverage chart is displayed. The selection can be moved by using the left and right arrow keys. Double clicking on a bar in the chart executes the *Show in Editor* command, see "Show in Editor" on page 2052.

Just below the horizontal axis is the *visibility line*. It underlines the bars that correspond to the visible nodes in the coverage tree in the Main window. "Visible" in this case means visible according to the visibility condition. Nodes that are hidden by collapsing a parent node are still regarded as visible in this context.

Quick Buttons

The following quick buttons are special to the Coverage Details window. The general quick buttons are described in "General Quick-Buttons" on page 24 in chapter 1, *User Interface and Basic Operations*.

Show in Editor
Corresponds to the description in "Show in Editor" on page 2052.

Increase Vertical Scale
Increases the vertical scale of the coverage chart by decreasing the value of the upper range of the vertical axis. Those bars that "overflows" the range of the vertical axis are shown with an up arrow at the top of the bars to indicate that the bars in reality are higher.

Decrease Vertical Scale
Decreases the vertical scale of the coverage chart by increasing the value of the upper range of the vertical axis. The reverse of the *Increase Vertical Scale* quick button above.

Show Coverage Tree
Pops up the Coverage Viewer's main window (the Coverage Tree window).

The Menu Bar

File Menu

The *File* menu contains the following menu choices:

- *Print*
  (See *"Printing from the SDL Suite" on page 307 in chapter 5, Printing Documents and Diagrams*.)
- *Close*
  (See "Close" on page 14 in chapter 1, *User Interface and Basic Operations*.)

View Menu

The *View* menu contains the following menu choices:

- *Window Options*
- *Chart Options*
- *Set Scale*

Window Options

Sets options for which parts of the Coverage Details window to show. The dialog controls whether to show the tool bar and the status bar.

Chart Options

Sets options controlling the appearance of the coverage chart.

The dialog controls the value of the upper limit of the vertical axis in the chart and whether to:

- *Show visibility line*
- *Hide Visibility line*

Set Scale

Issues a dialog where the scale for the Coverage Details window may be set.

Tools Menu

The *Tools* menu contains the following menu choices:

- *Show in Editor*
- *Show Coverage Tree*

Show in Editor

Opens an SDL Editor for all the transitions/symbols of the selected vertical bar in the coverage chart. The diagram symbols corresponding to the transitions/symbols become selected in the SDL Editor.

A confirmation dialog is displayed between each diagram page.

Show Coverage Tree

Raises the Coverage Viewer's main window.

Popup Menu

The following table lists the menu choices in the Coverage Details window popup menu and a reference to the corresponding menu choice in the menu bar.

Show Coverage Tree	"Show Coverage Tree" on page 2052.

Keyboard Accelerators

Apart from the general keyboard accelerators, the following accelerators can be used in the Coverage Details window:

Accelerator	**Reference to corresponding command**
`Ctrl+E`	"Show in Editor" on page 2052

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