NuSRS 2.0
User Manual (ver.1.1)

http://dependable.kaist.ac.kr/~nusrs
nusrs@dependable.kaist.ac.kr

Dependable Software lab.
KAIST

Contents

- NuSRS 2.0 Introduction
- NuSRS 2.0 Structural Overview
- NuSRS 2.0 Constructs
- Detailed description of NuSRS 2.0
  - Menu functions, Toolbar
  - Hierarchy Window
  - Description Window
  - FOD, FSM(TTS), SDT Edit Window
  - Type Window
  - Quick Check
  - Model Checking

KAIST

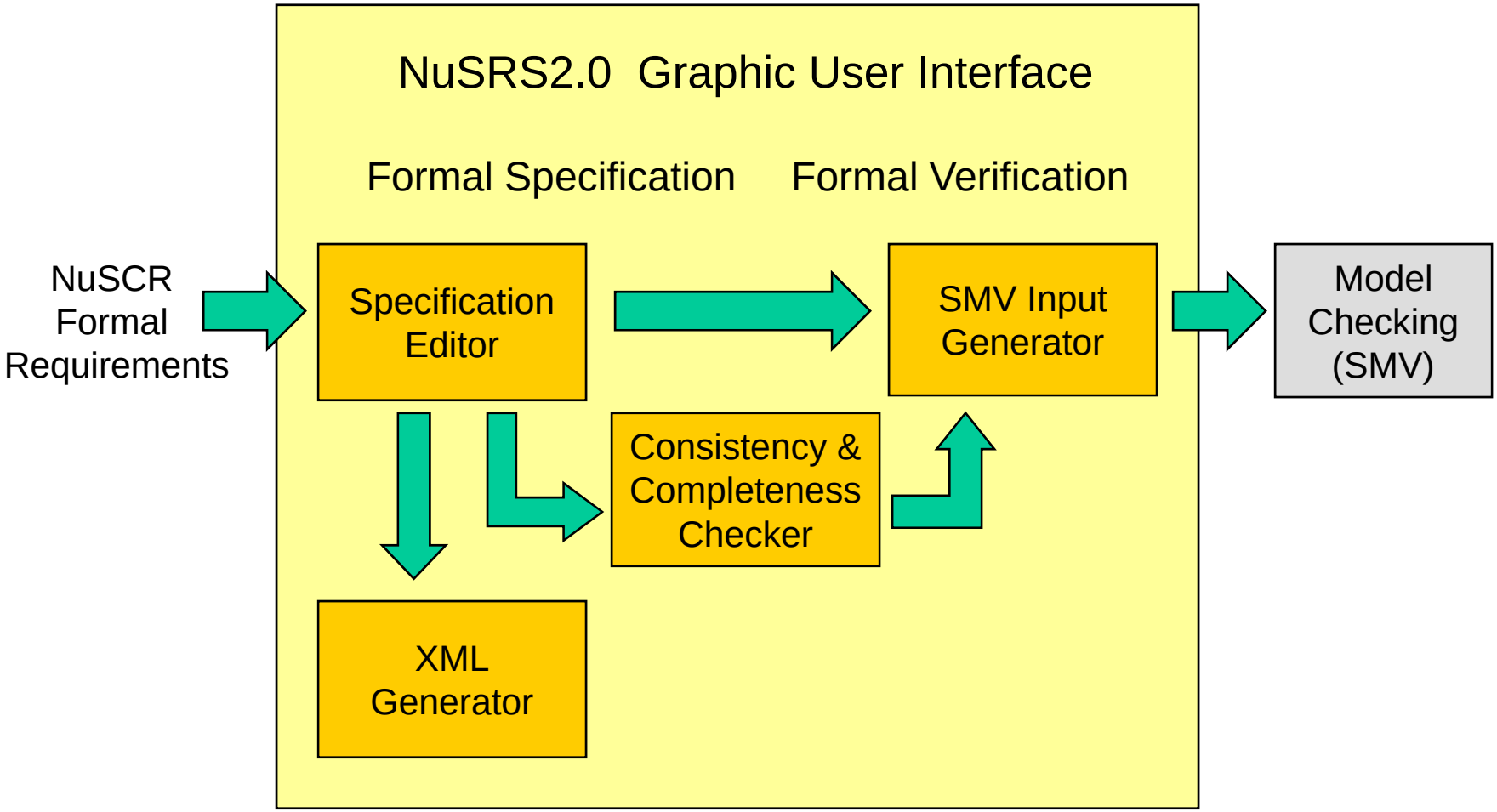
NuSRS 2.0 Introduction

- Automatic tool to support requirement specification and formal verification of NuSCR model

- Development language: Java
- Development environment: eclipse 3.1 (JDK 1.5)
- Environment
  - Windows OS(recommendation)
  - PC with JDK or JRE (ver. 1.5 or higher) installed

KAIST

NuSRS 2.0 Structural Overview



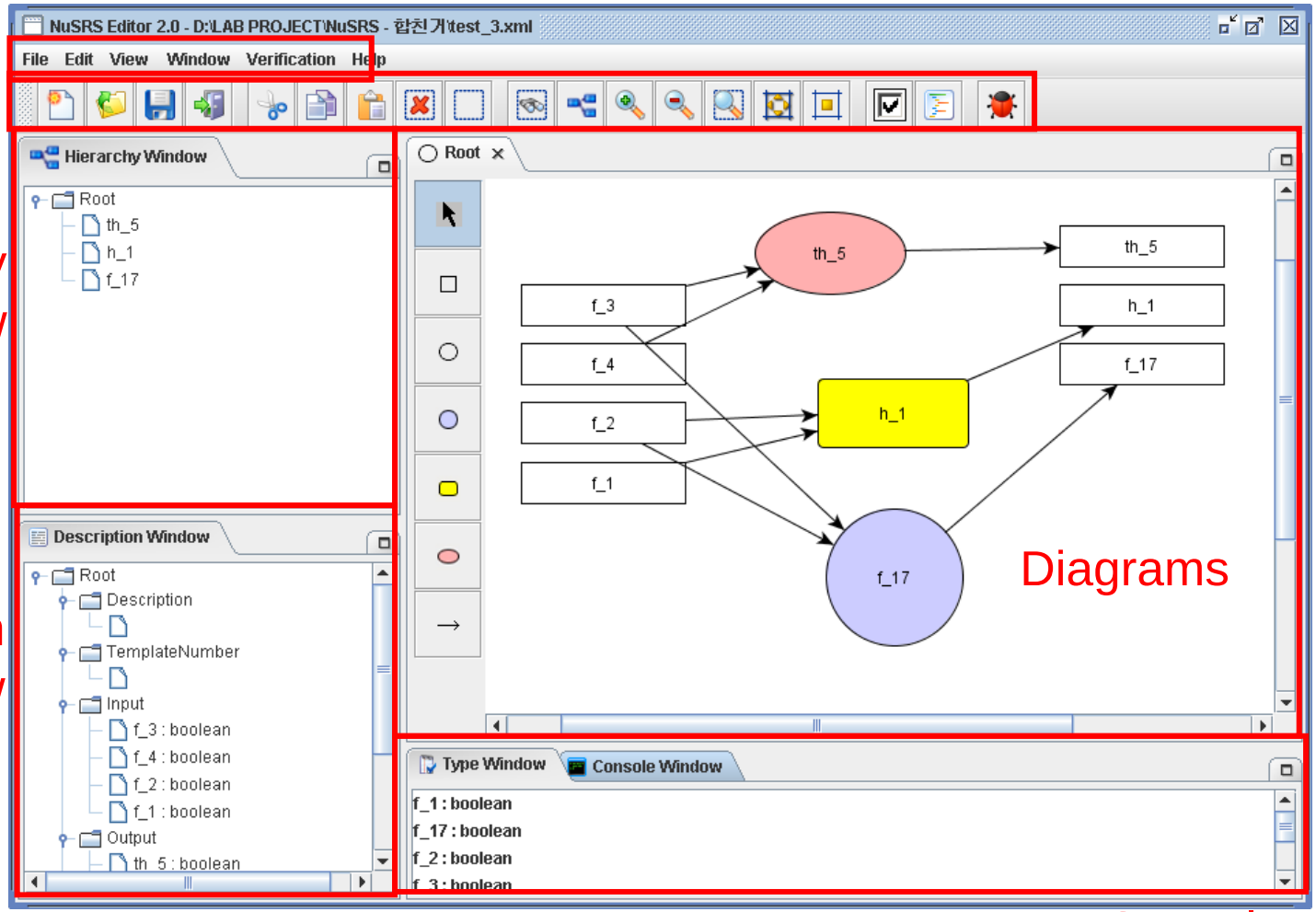
NuSRS2.0 Constructs

Menu

Toolbar

Hierarchy Window

Description Window



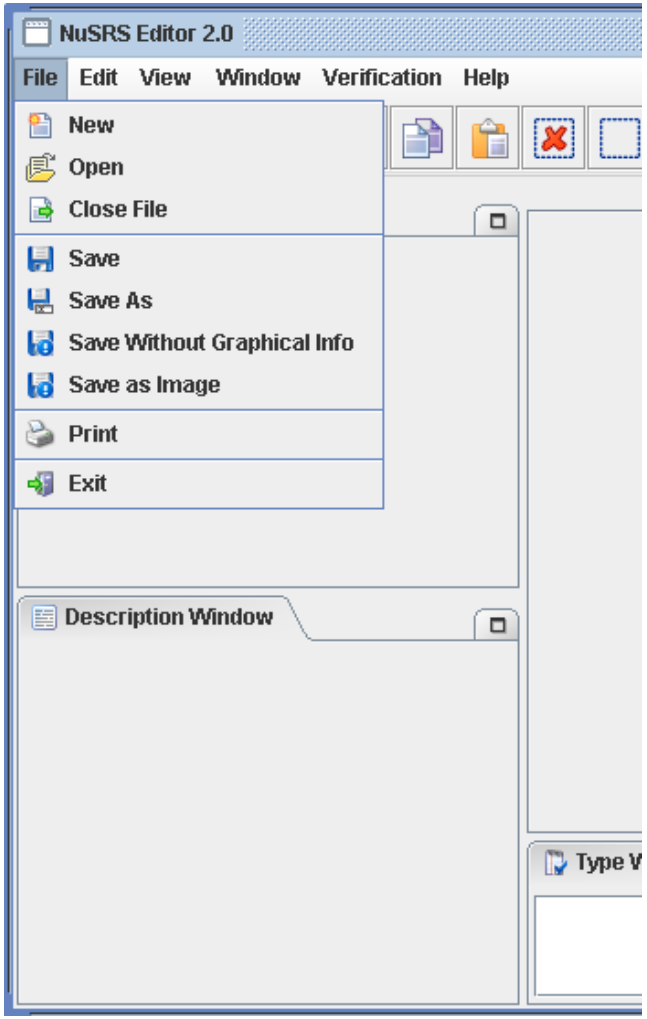
Type & Console Window

KAIST

Menu Functions, Toolbar

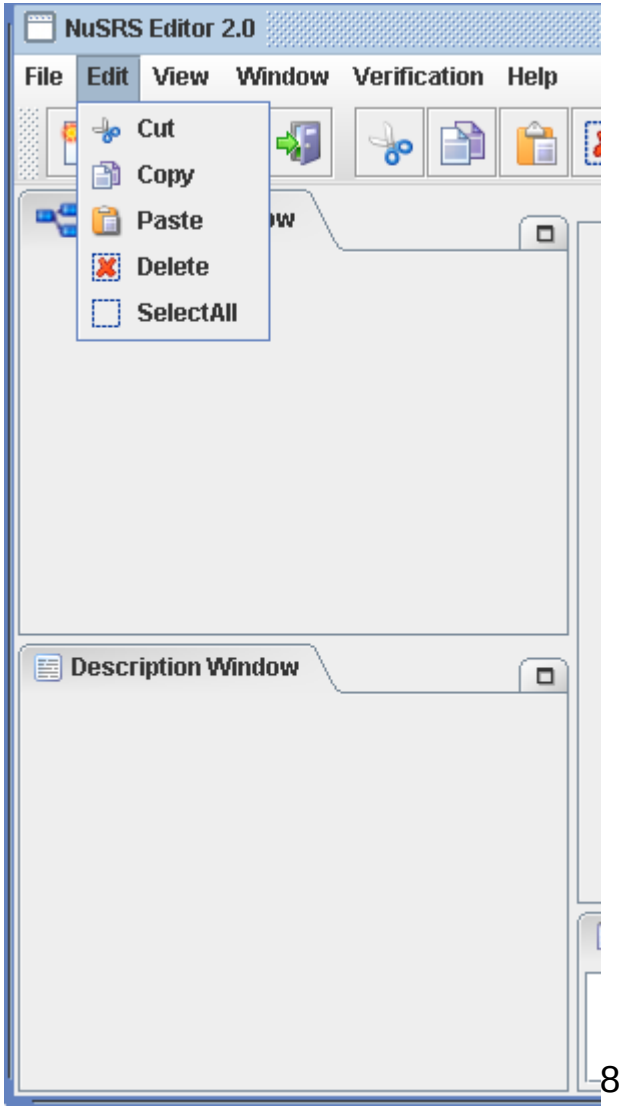
Menu > File

- *File*
  - *New* – Create new file
  - *Open* – Open file
  - *Close File* – Close file
  - *Save* – Save file
  - *Save As* – Save file as another name
  - *Save Without Graphical Info* – Save file without graphical information
  - *Save as Image* – Save file as image
  - *Print* – Print
  - *Exit* – Exit program



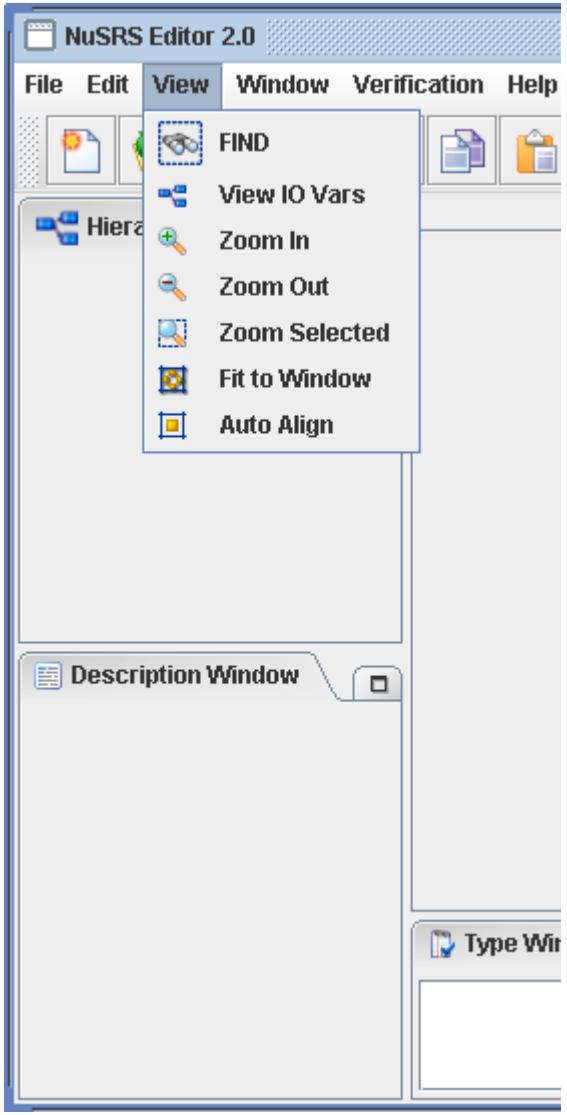
Menu > Edit

- *Edit*
  - *Cut* – Cut Selected
  - *Copy* – Copy Selected
  - *Paste* – Paste Selected
  - *Delete* – Delete Selected
  - *SelectAll* – *Select All nodes*



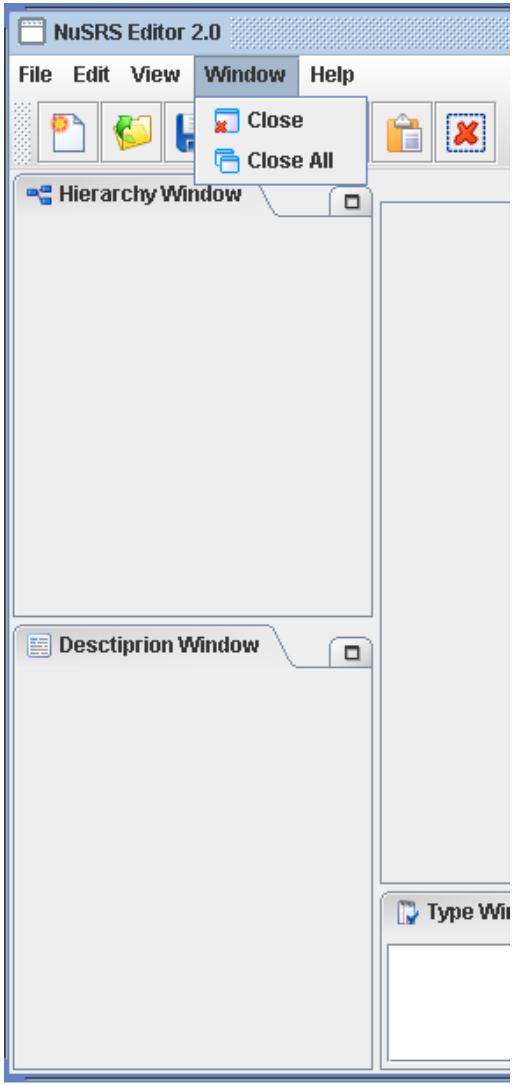
Menu > View

- *View*
  - *FIND* – *Find node*
  - *View IO Vars* – *View list of IO Variables*
  - *Zoom In* – *Zoom In*
  - *Zoom Out* – Zoom Out
  - *Zoom Selected* – Zoom Selected
  - *Fit to Window* – Zoom in or out depending on window size
  - *Auto Align* – Auto Align



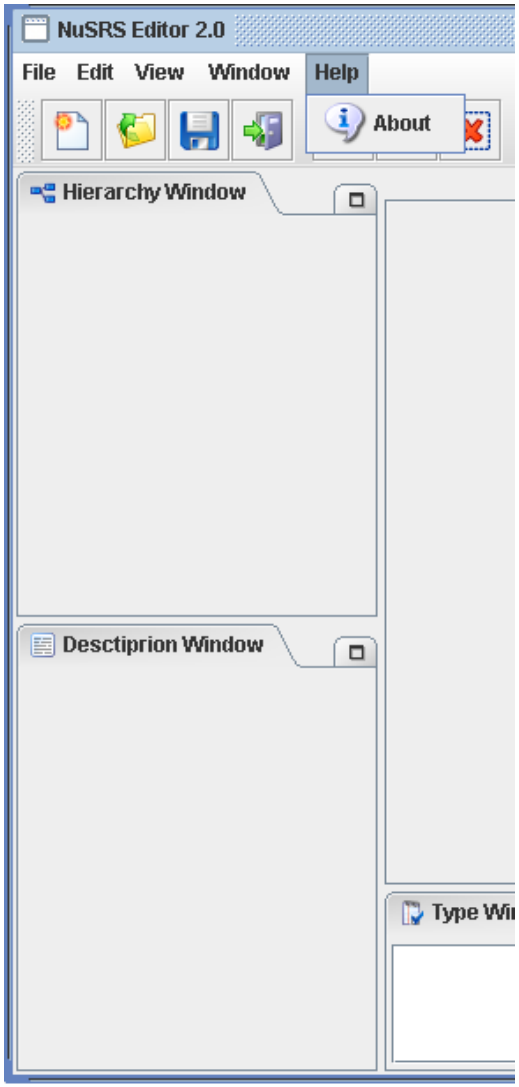
Menu > Window

- *Window*
  - *Close* – Close the editing Window
  - *Close All Windows* – Close all Windows



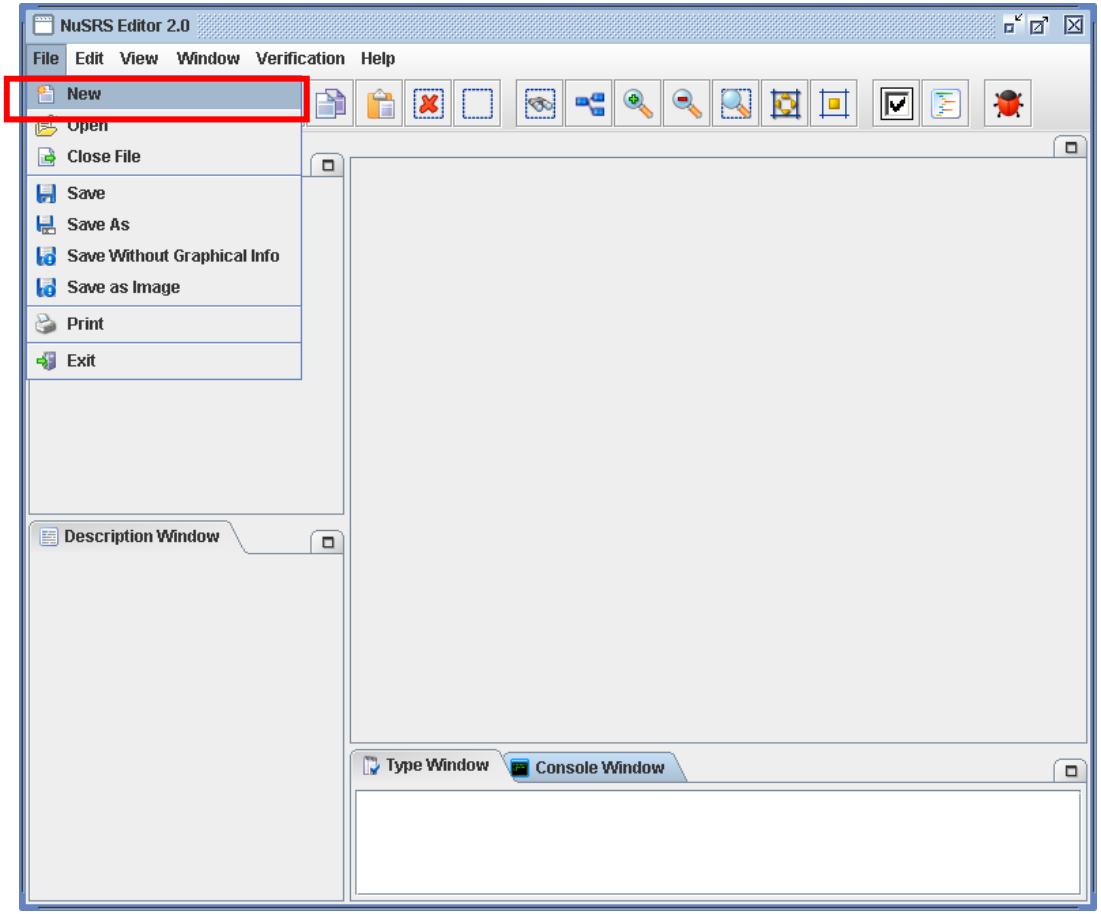
Menu > Help

- *Help*
  - *About* – Give information on NuSRS



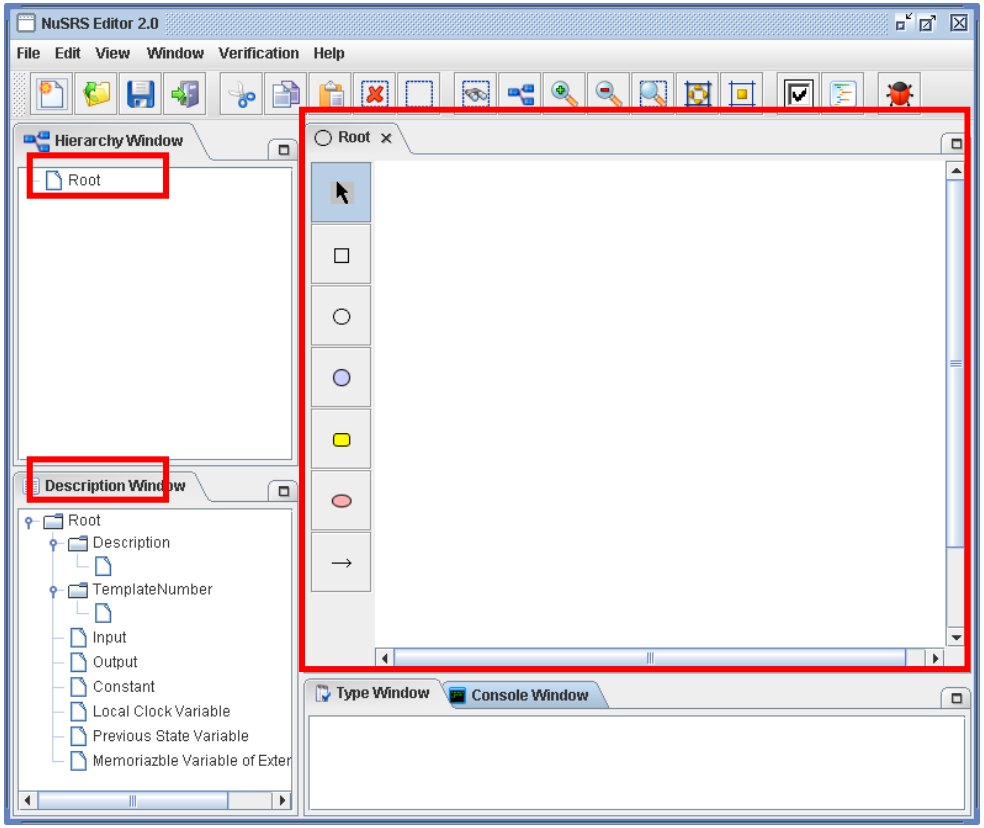
Create new file (1/2)

1. Select File > New in Menu.



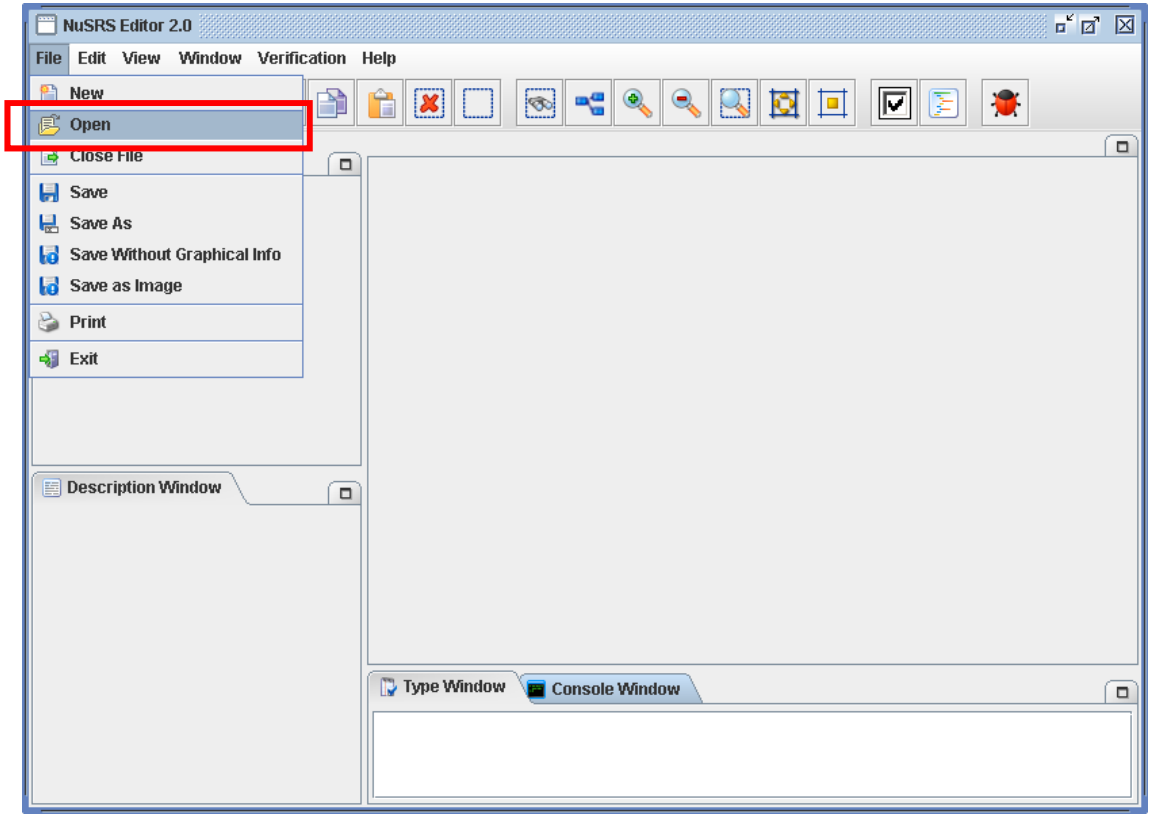
Create new file (2/2)

2. Under the hierarchy, the root is created inside the description window, and a window for drawing the root node is created



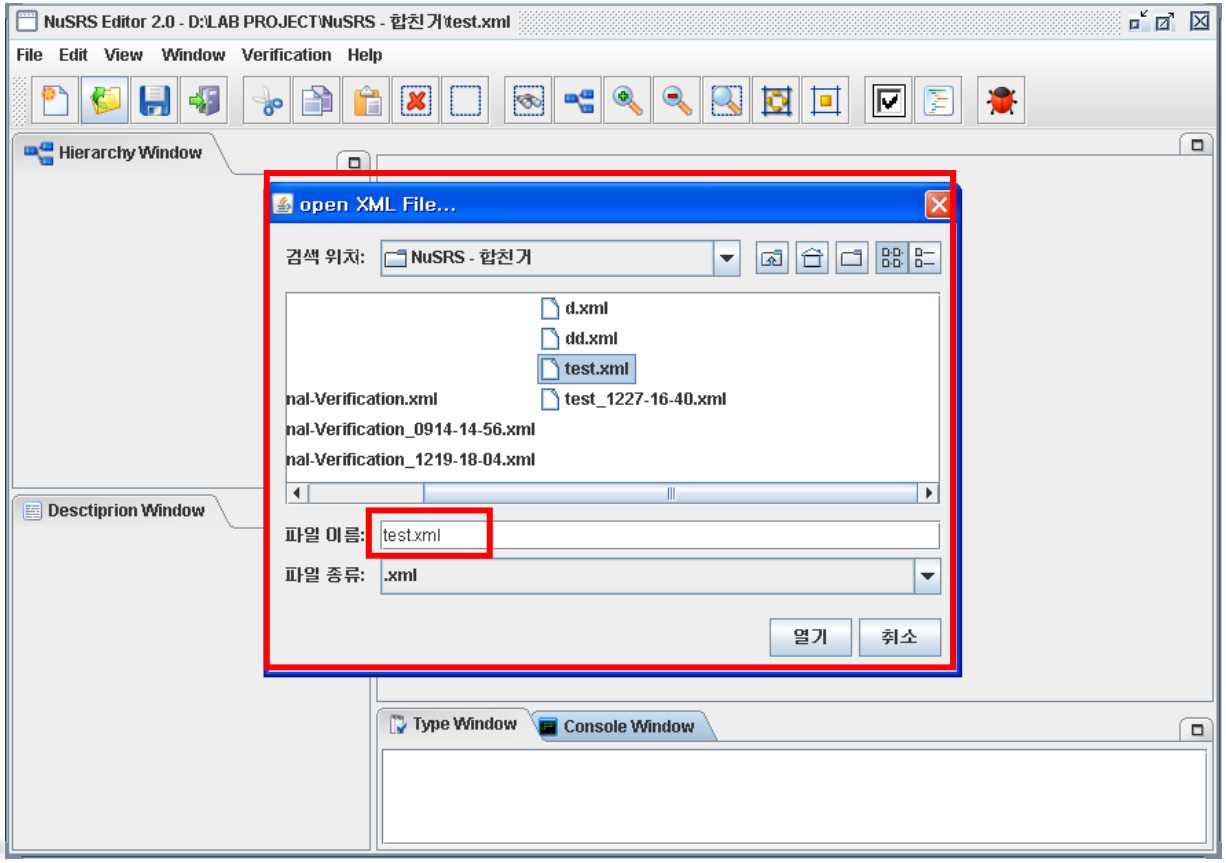
Load file (1/3)

1. Select File > Open in Menu.
   - Open files that were created in NuSRS with .xml suffix



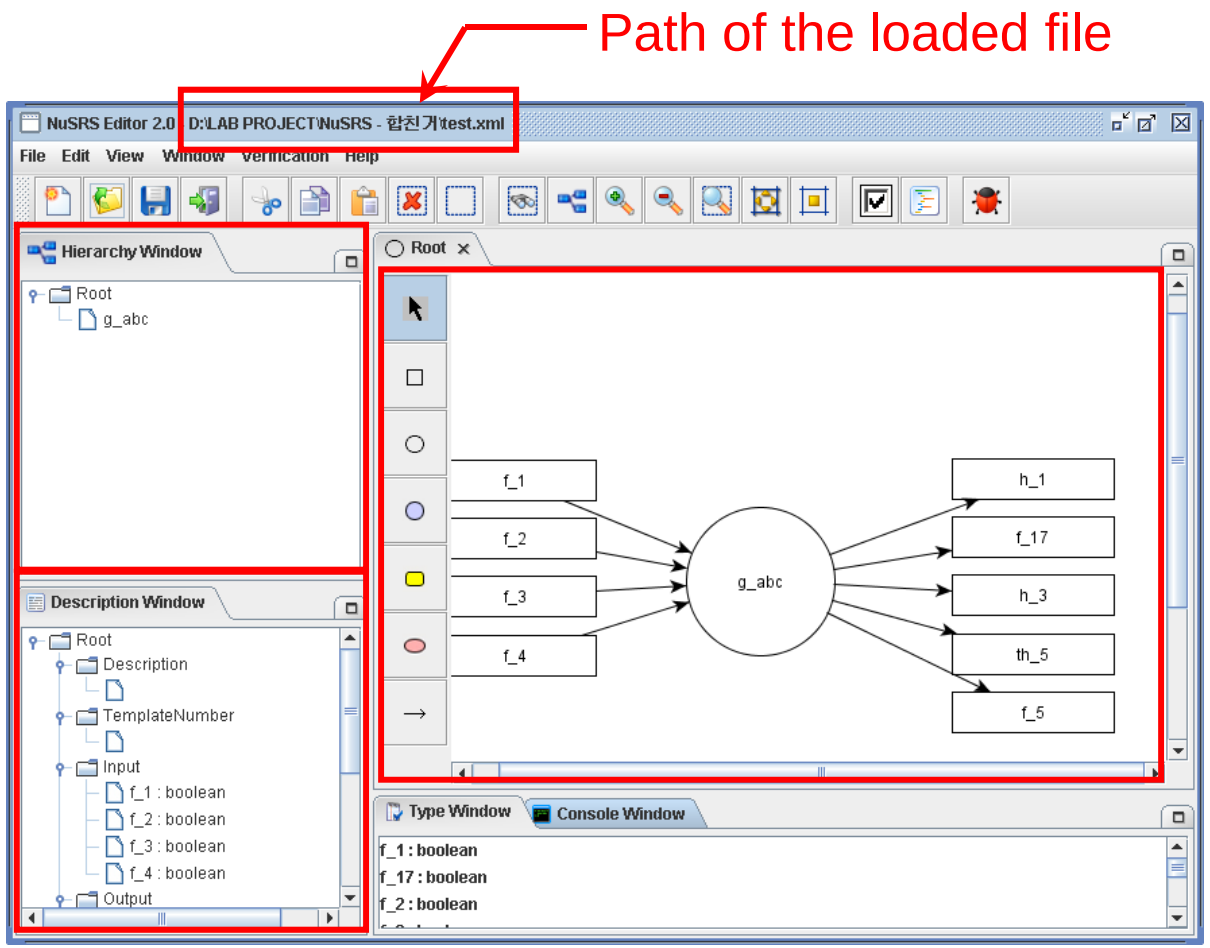
Load file (2/3)

2. When the dialog box opens, select the file to load.



Load file (3/3)

3. File loading completed.



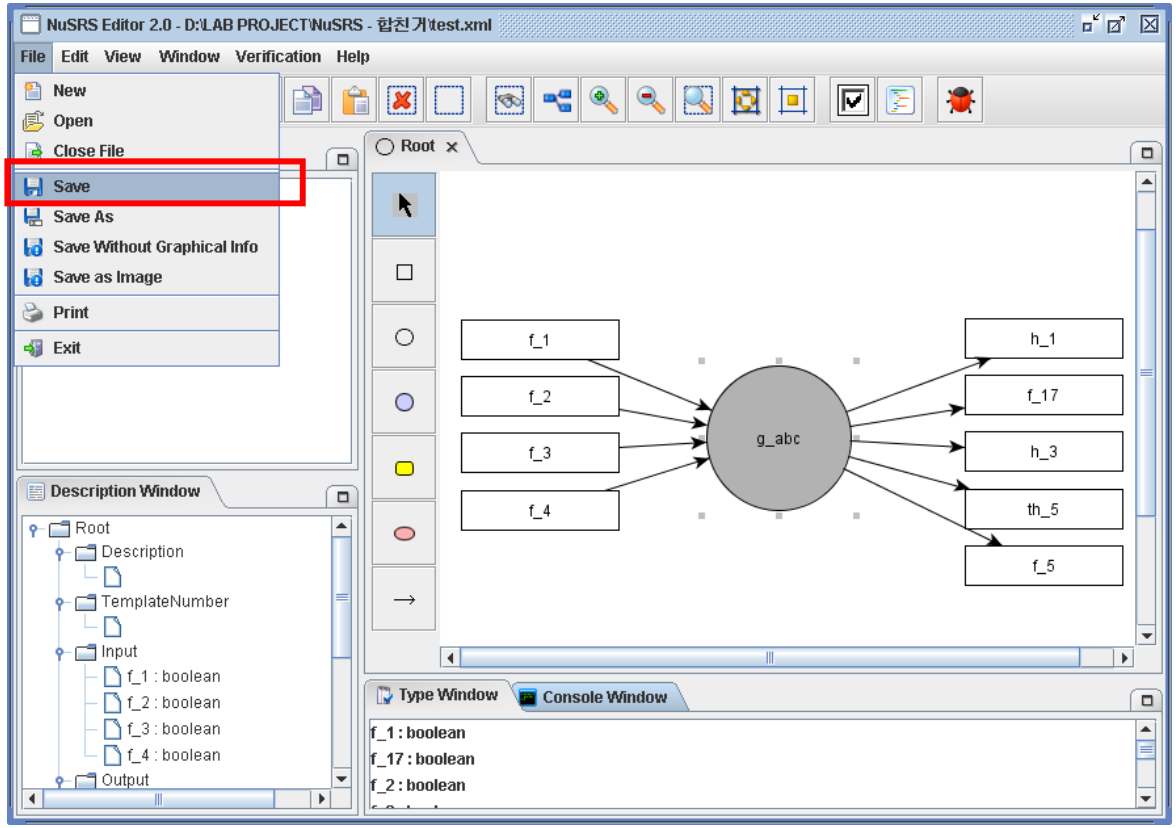
Structure of the loaded file

Details of the loaded file

Diagram of the loaded file

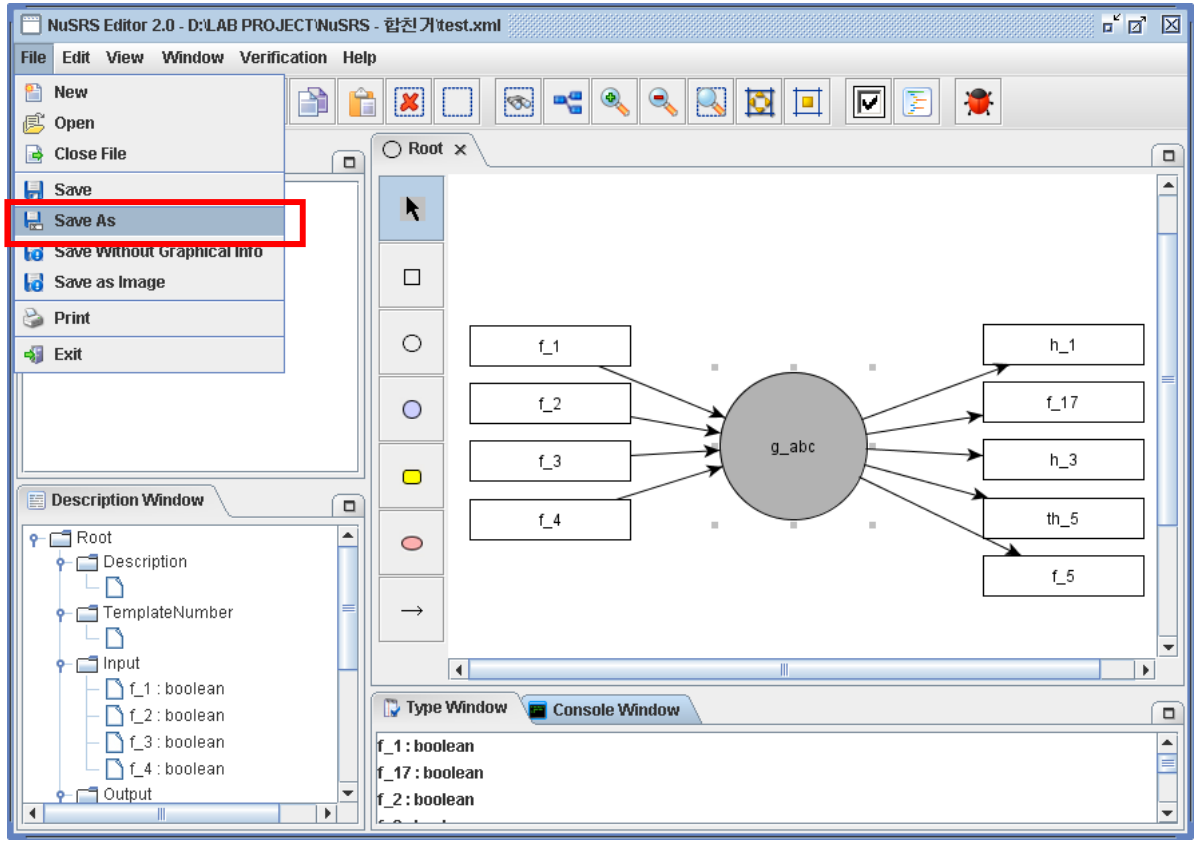
Save file

1. Select File > Save in Menu. The current file is then saved.



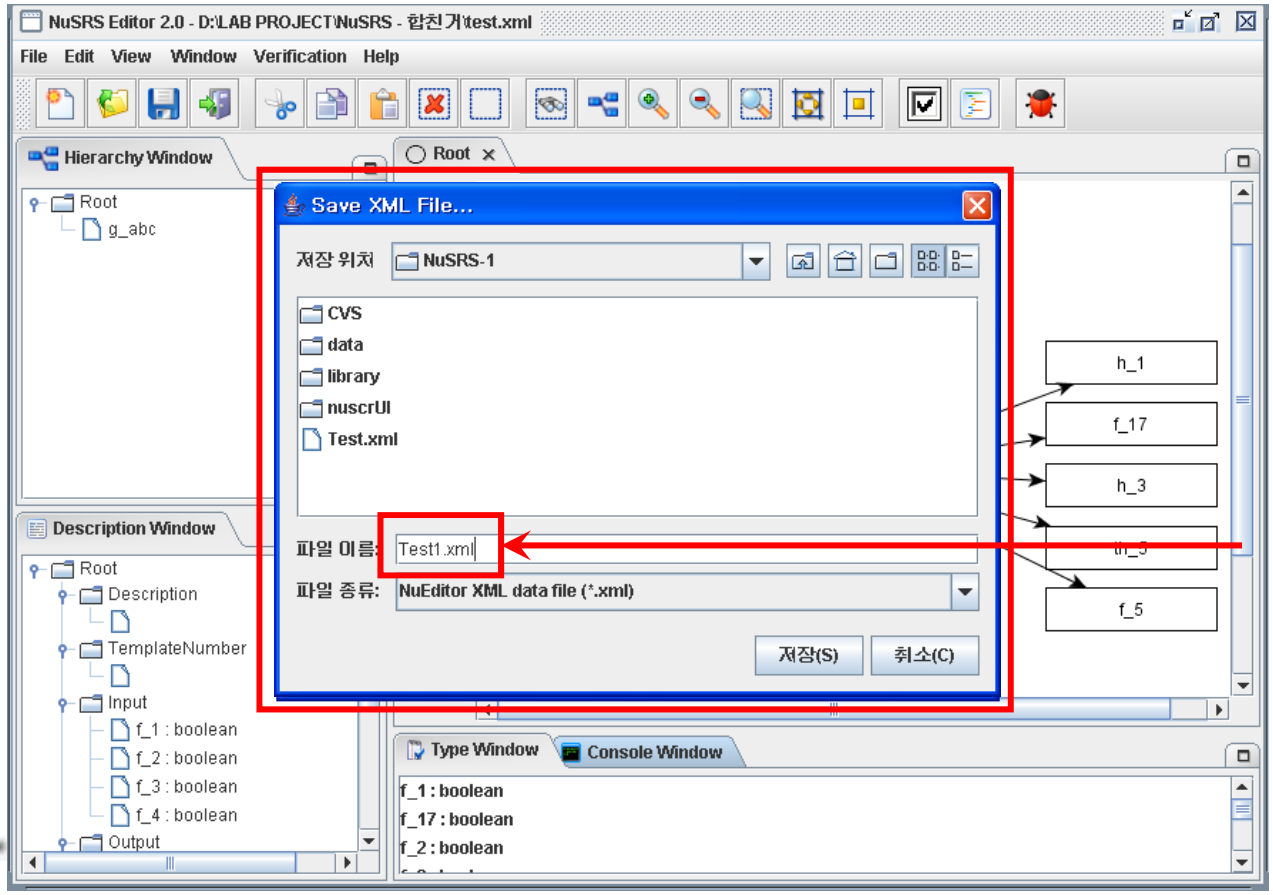
Save As (1/2)

1. Select File > Save As in Menu.



Save As (2/2)

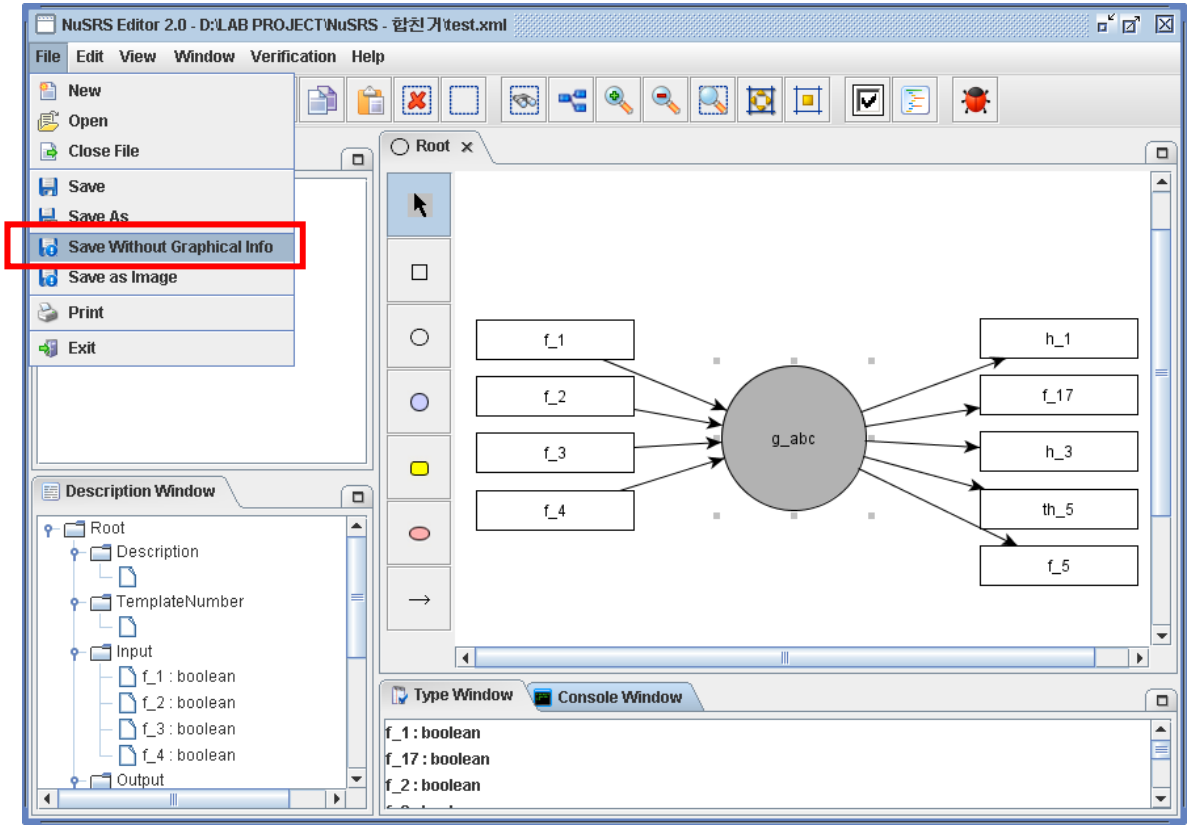
2. When the dialog box opens, input a file name and click save. The current file is saved.



Save as Test1.xml

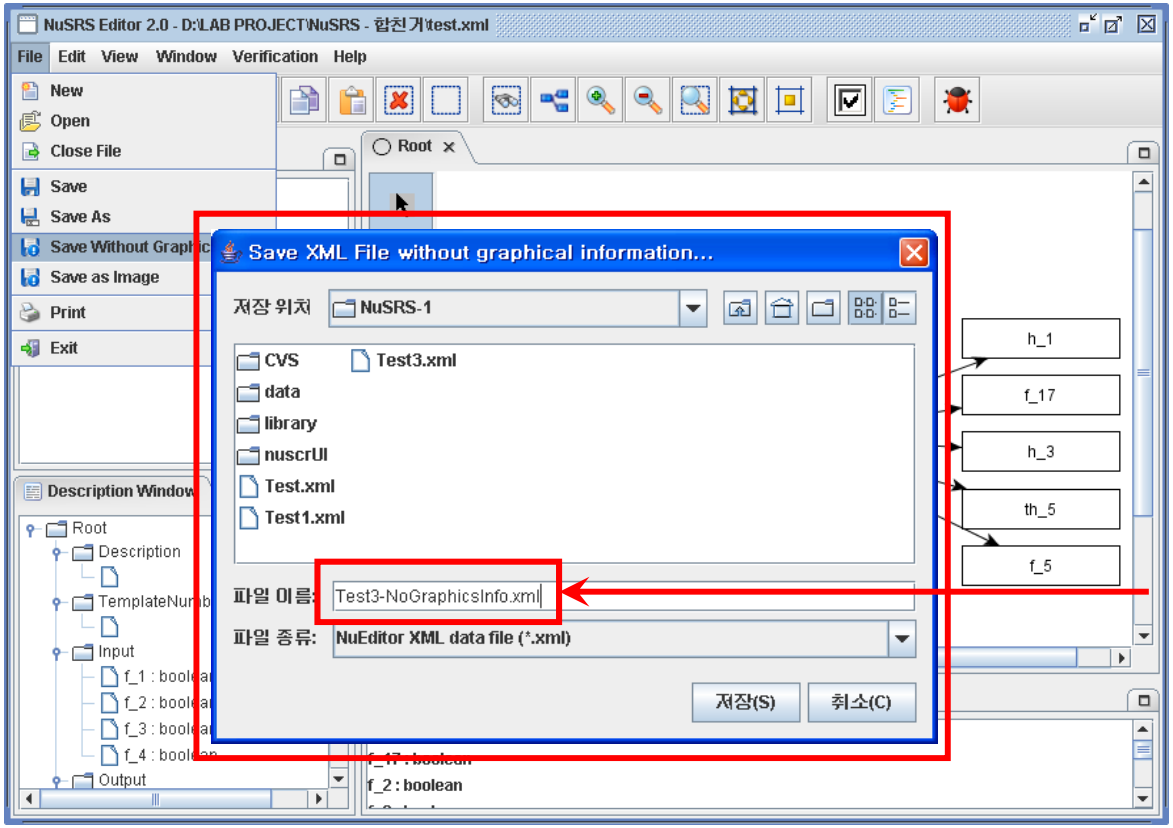
Save without Graphical Info (1/2)

1. Select File > Save Without Graphical Info in Menu.



Save without Graphical Info (2/2)

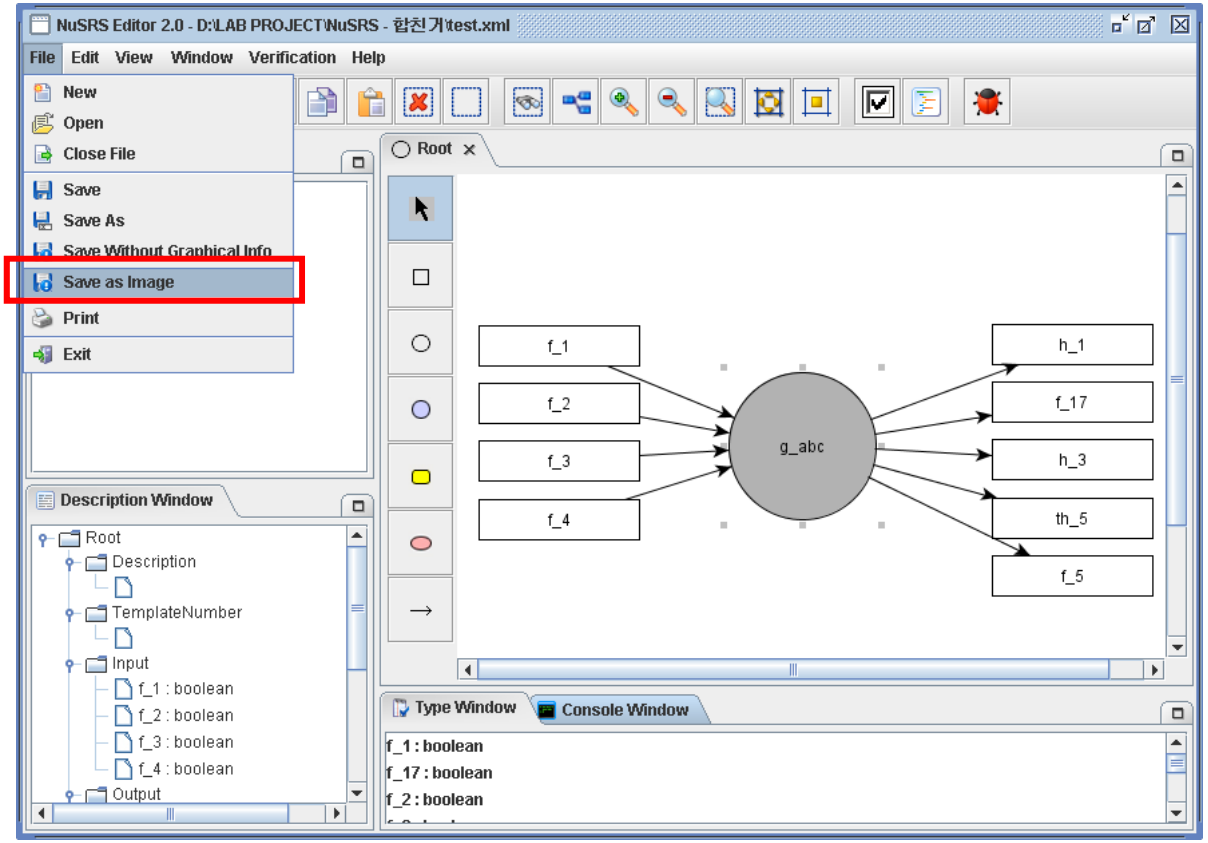
2. When the dialog box opens, input a new file name and click save. The current file is saved without graphical information.



Save as user assigned name.xml

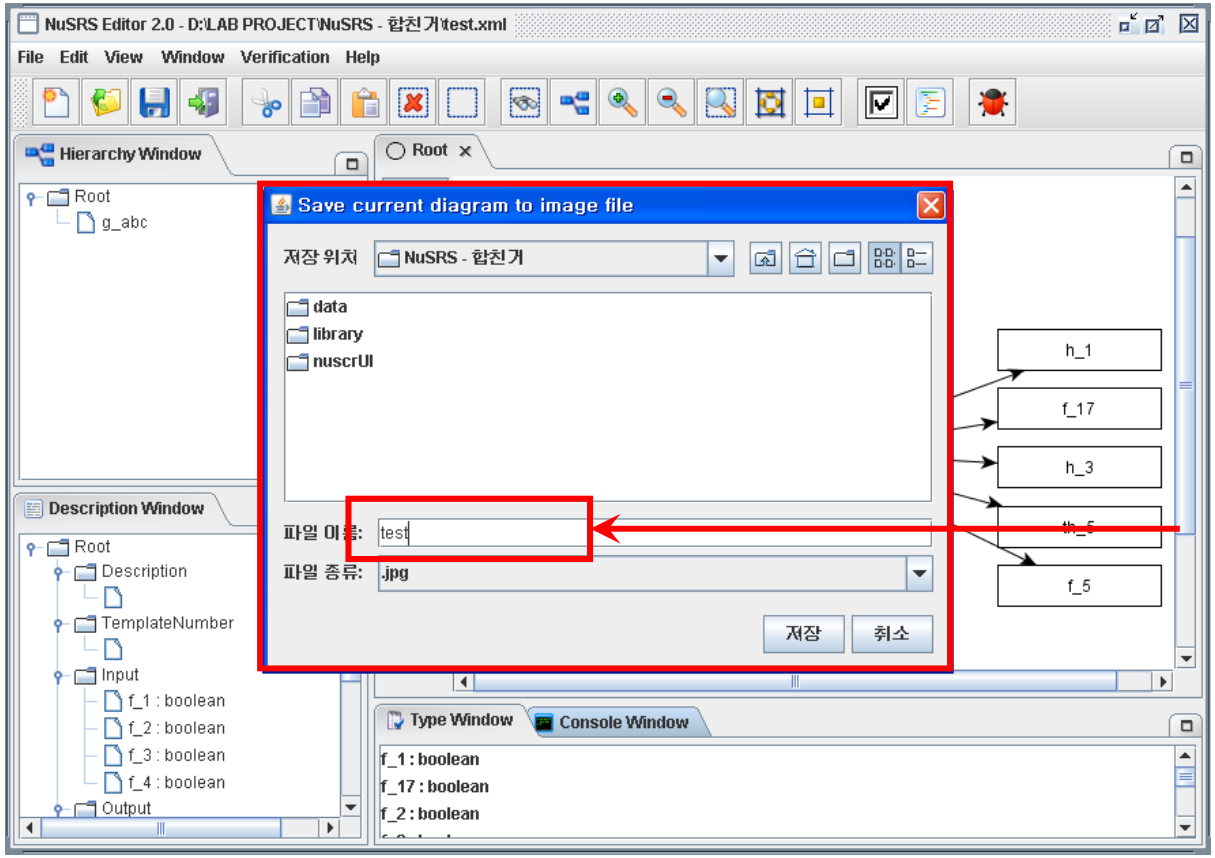
Save as Image (1/2)

1. Select File > Save as Image in Menu.



Save as Image (2/2)

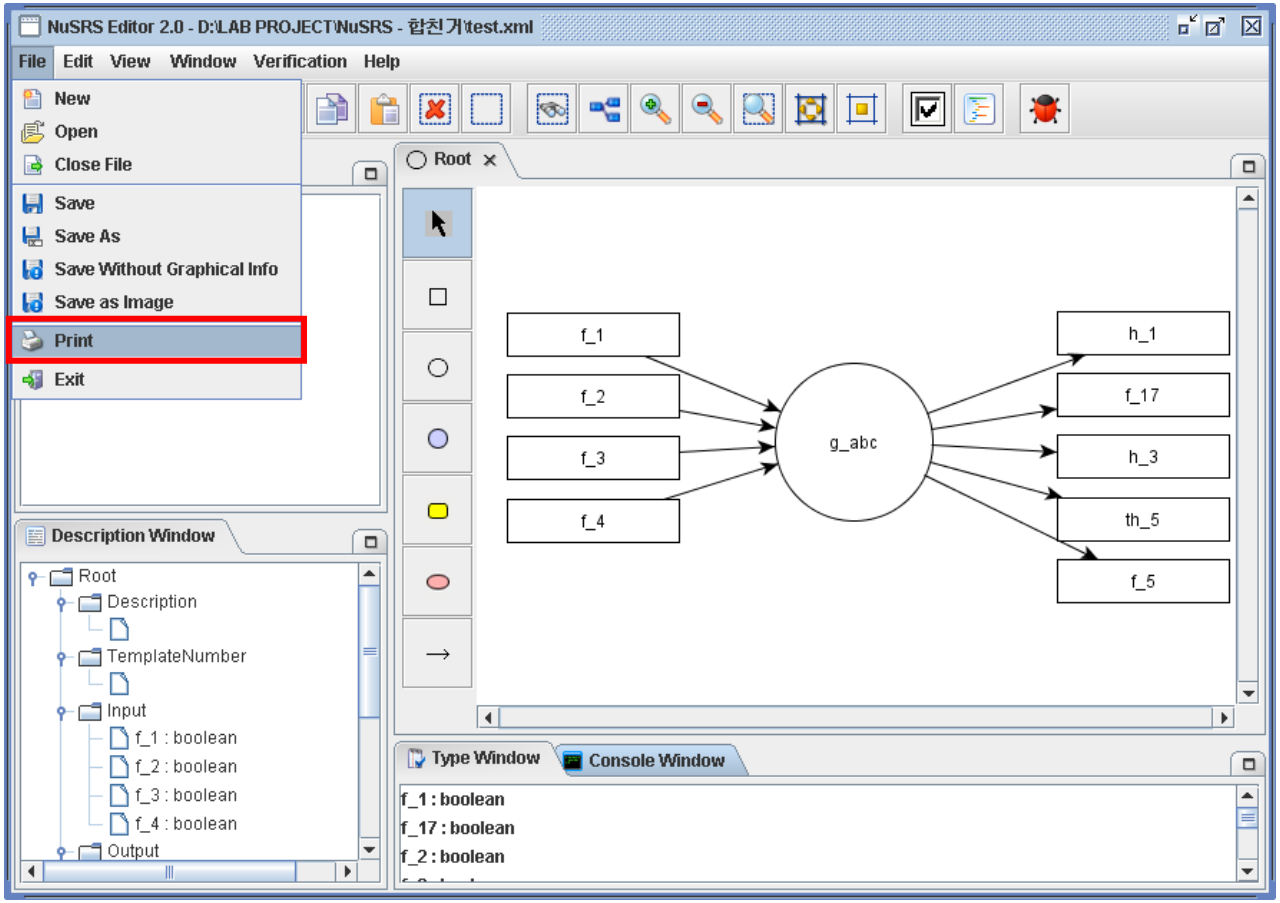
2. When the dialog box opens, input a new file name and click save. The current file is saved as an image file.



Save as user assigned name.jpg

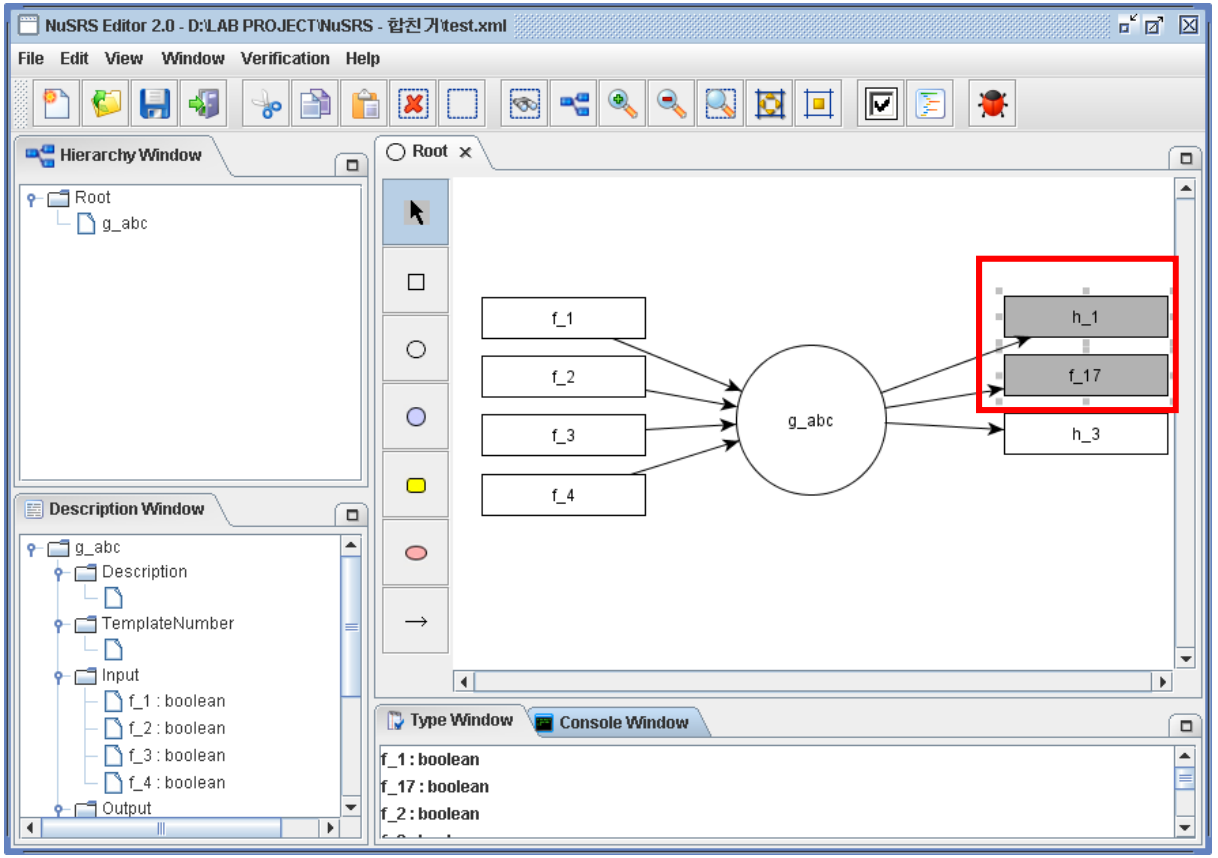
Print

1. Select File > Print in Menu.



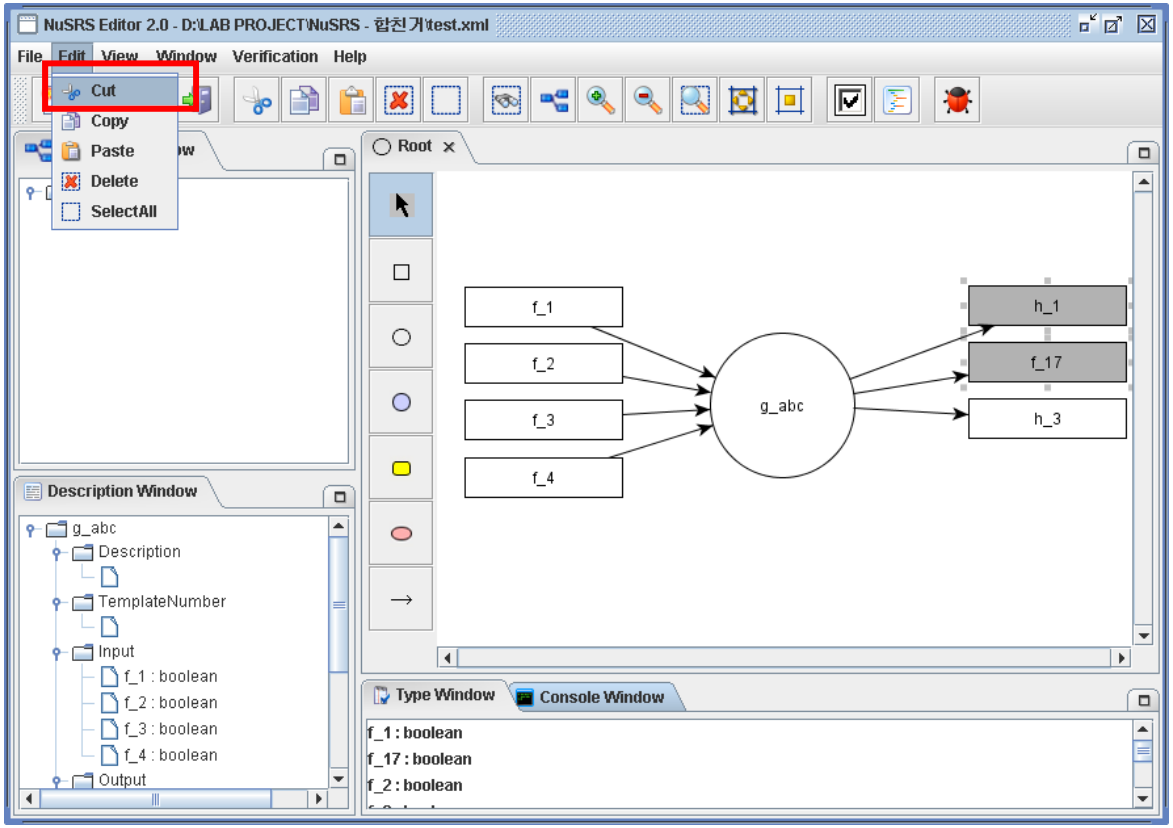
Edit > Cut (1/2)

1. Select the area to be cut by clicking the left mouse button or by drag & drop.



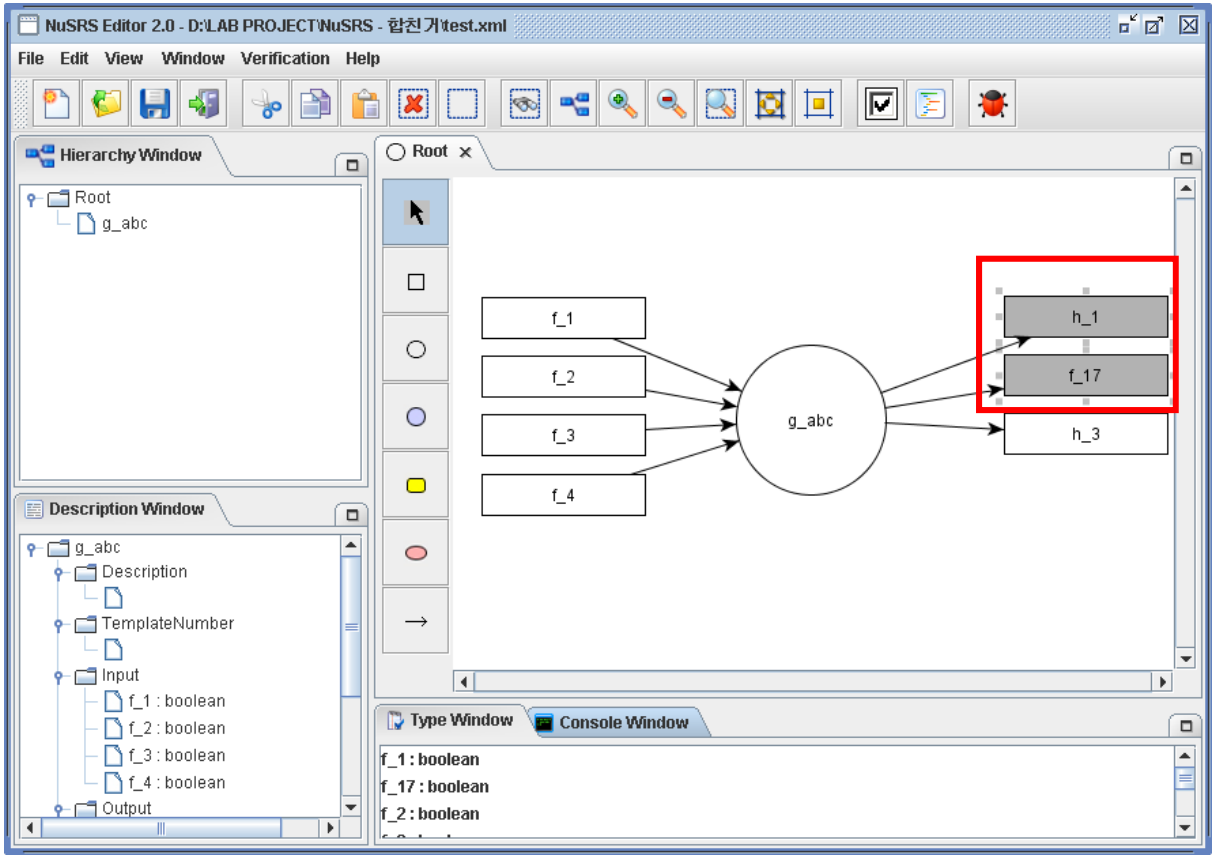
Edit > Cut (2/2)

2. Select Edit > Cut (or press Ctrl + X). The selected area is then cut.



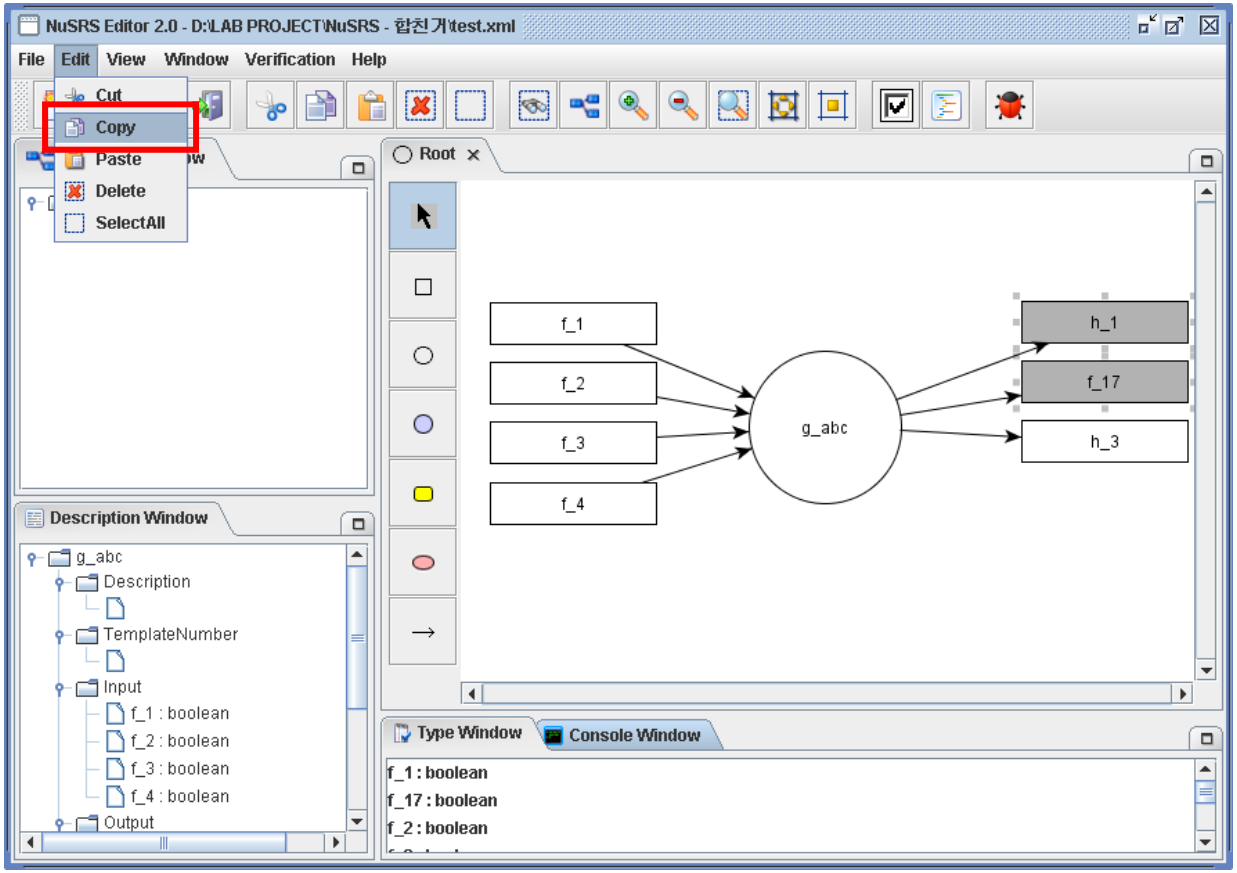
Edit > Copy (1/2)

1. Select the area to be copied by clicking the left mouse button or by drag & drop.



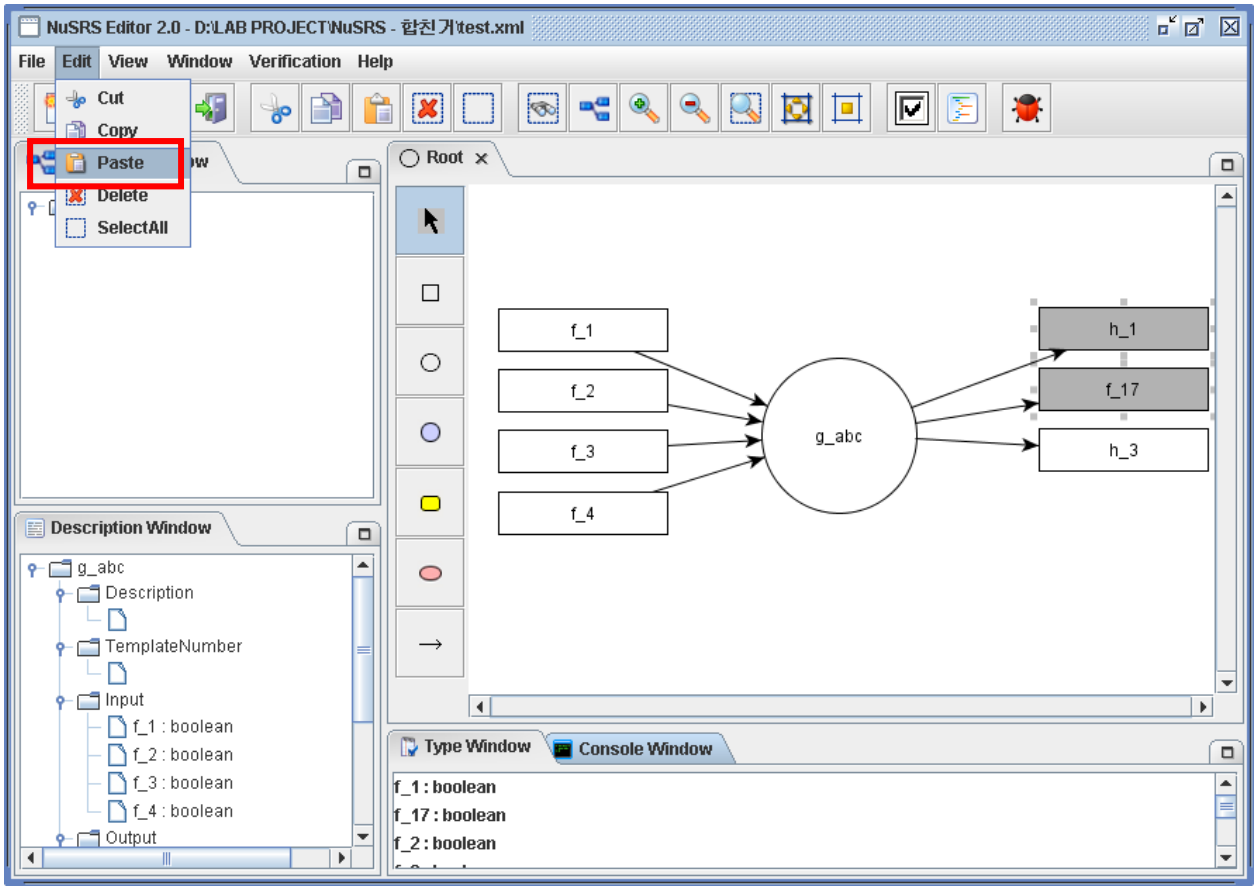
Edit > Copy (2/2)

2. Select Edit > Copy (or press Ctrl + C). The selected area is then copied.



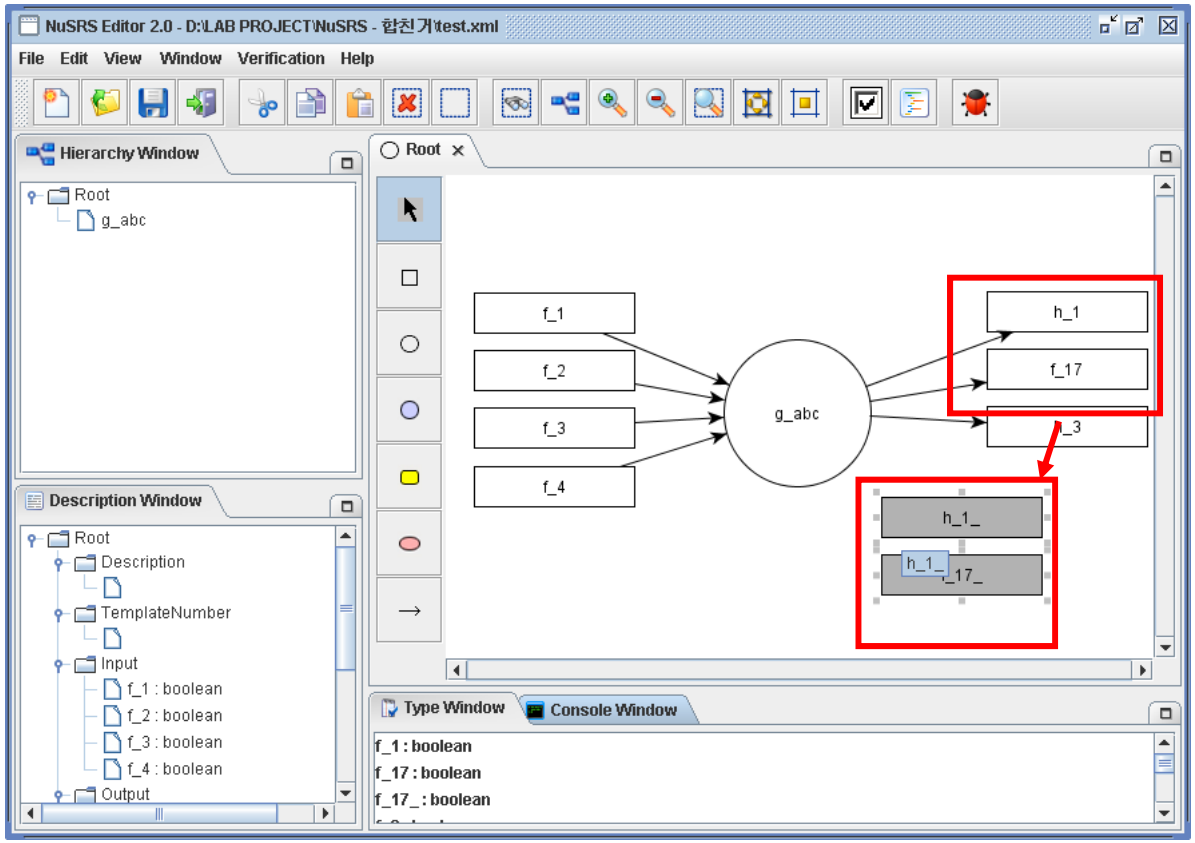
Edit > Paste (1/4)

1. Select Edit > Paste. (or press Ctrl + V)



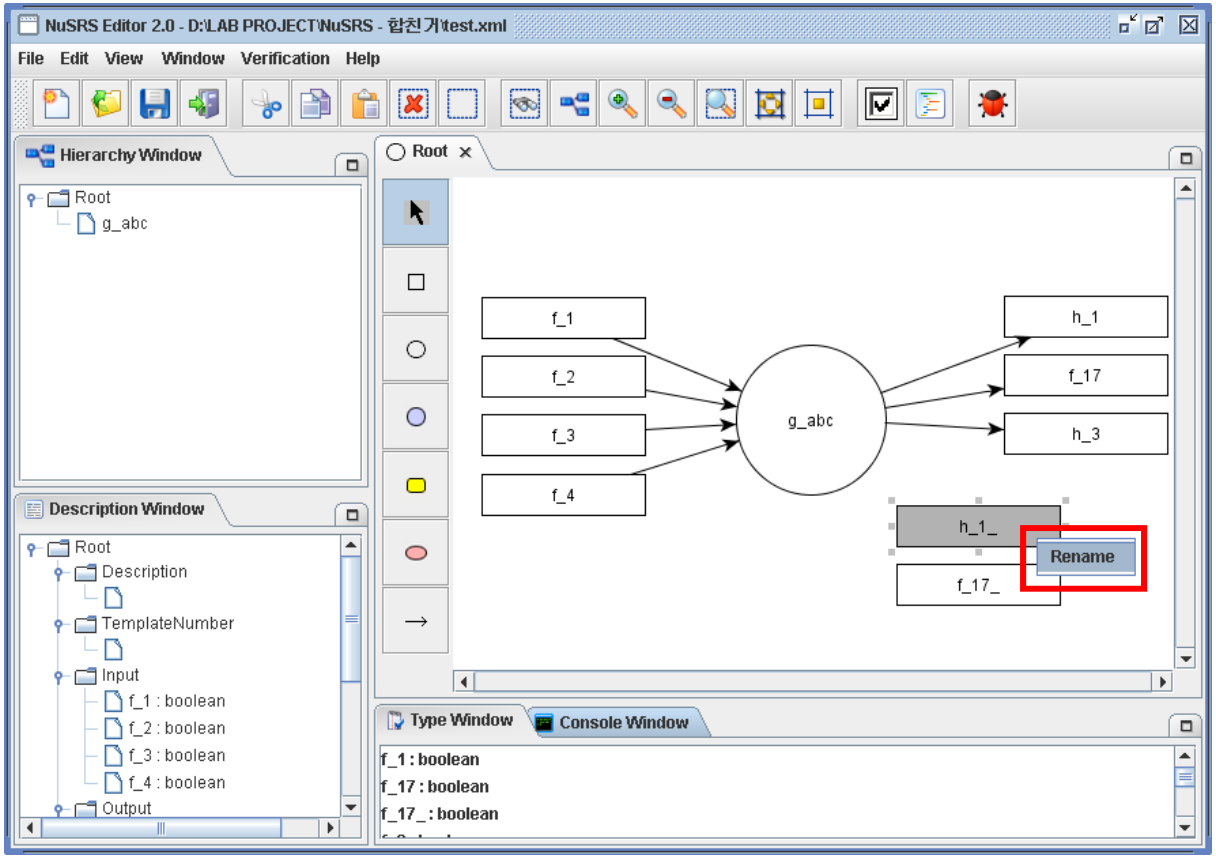
Edit > Paste (2/4)

2. Selected constructs are pasted with different names.



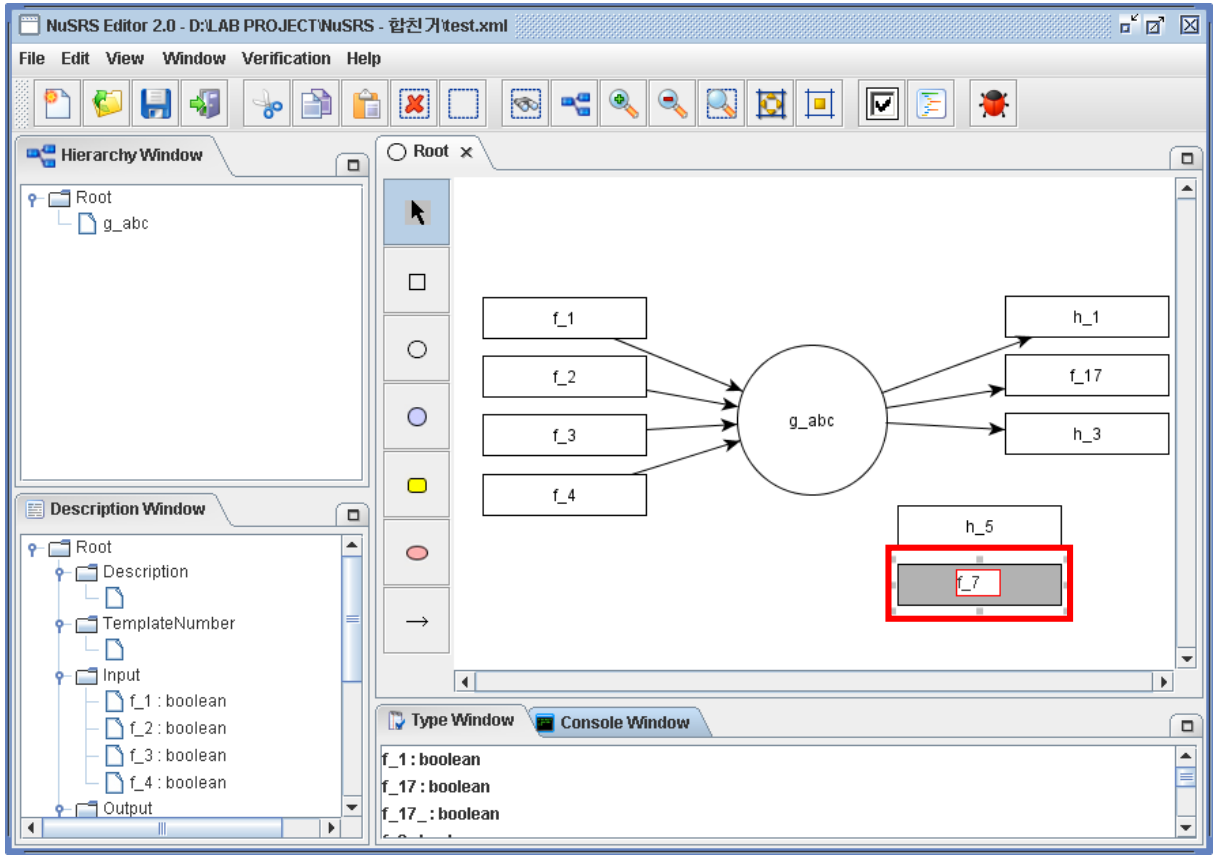
Edit > Paste (3/4)

3. Select the pasted node, click the right mouse button and select rename.



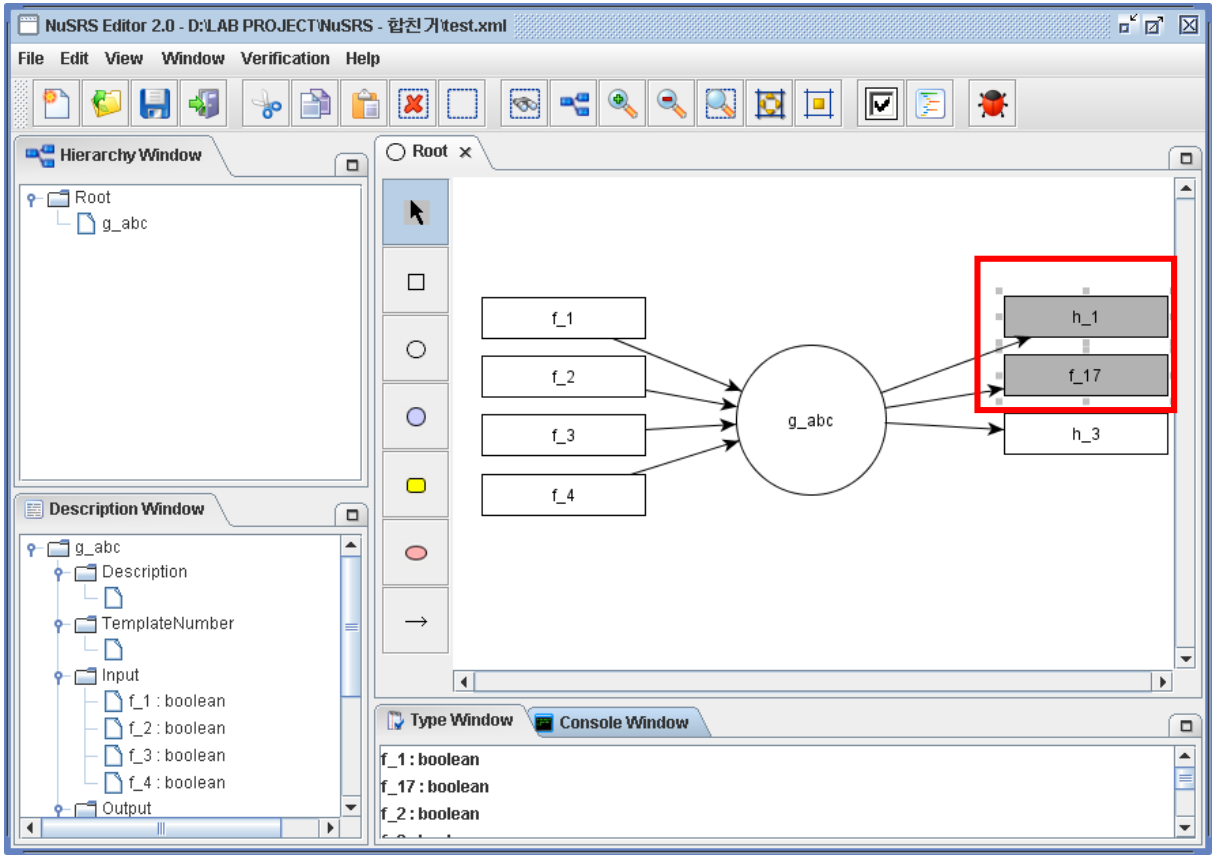
Edit > Paste (4/4)

4. Change the name of the pasted node appropriately.



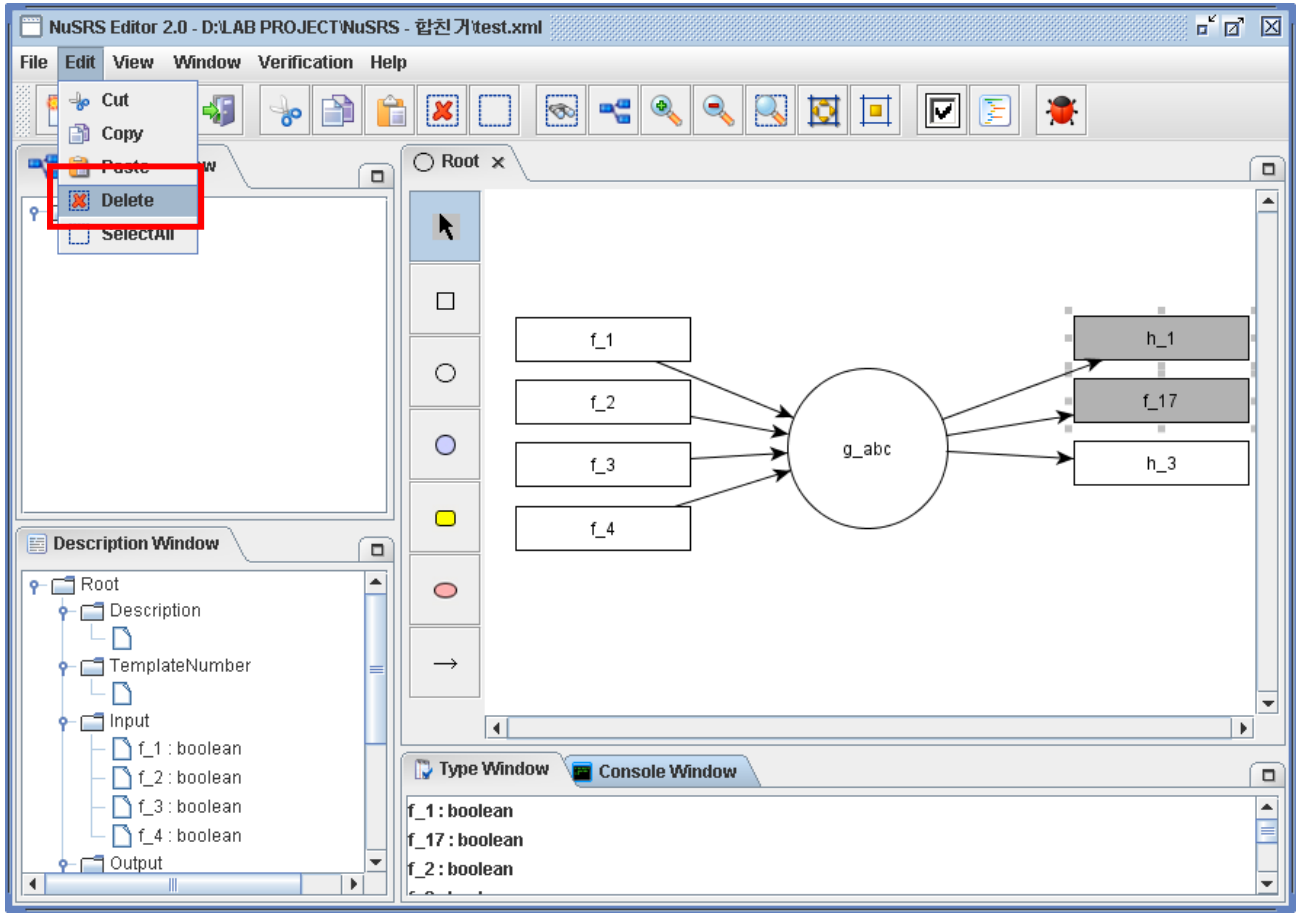
Edit > Delete (1/3)

1. Select the area to be deleted by clicking the left mouse button or by drag & drop.



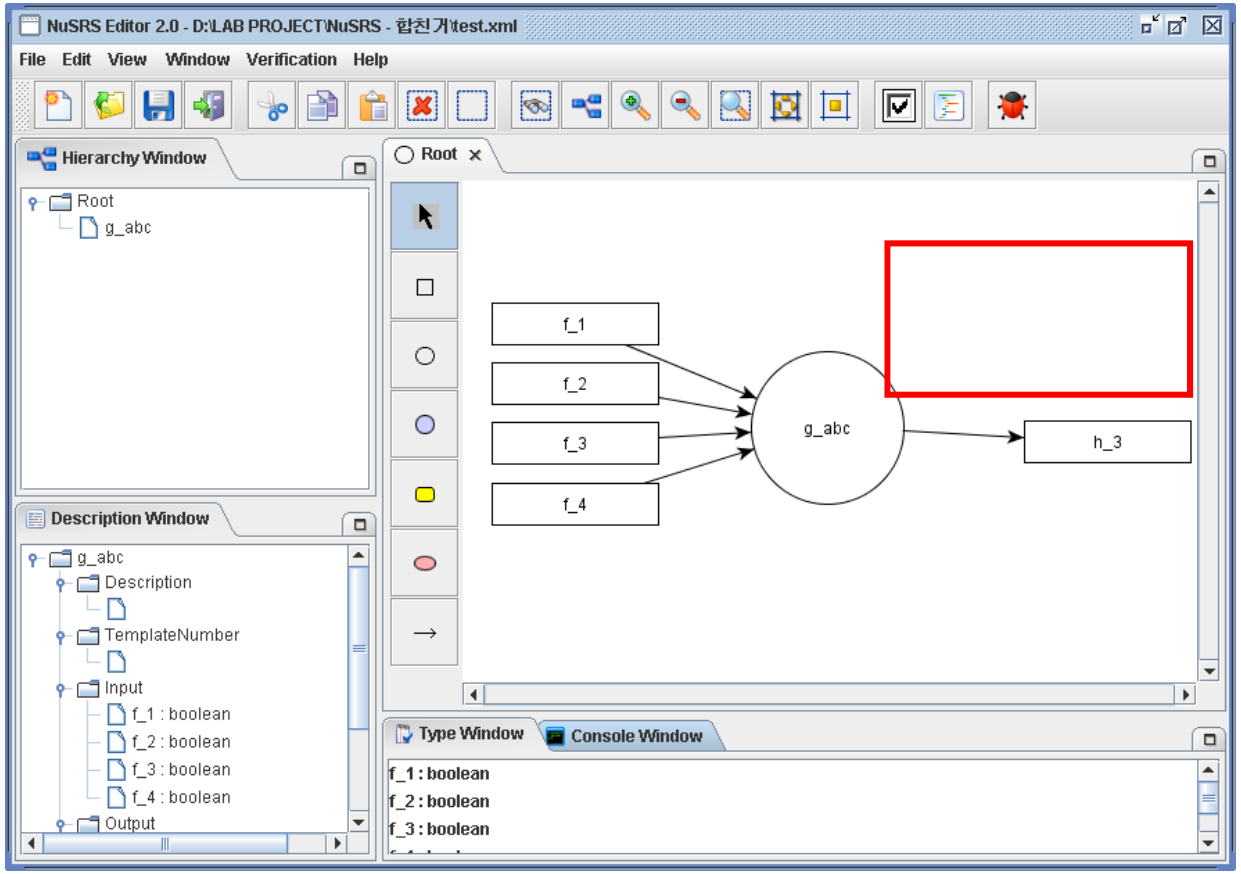
Edit > Delete (2/3)

2. Select Edit > Delete. (or press Delete key)



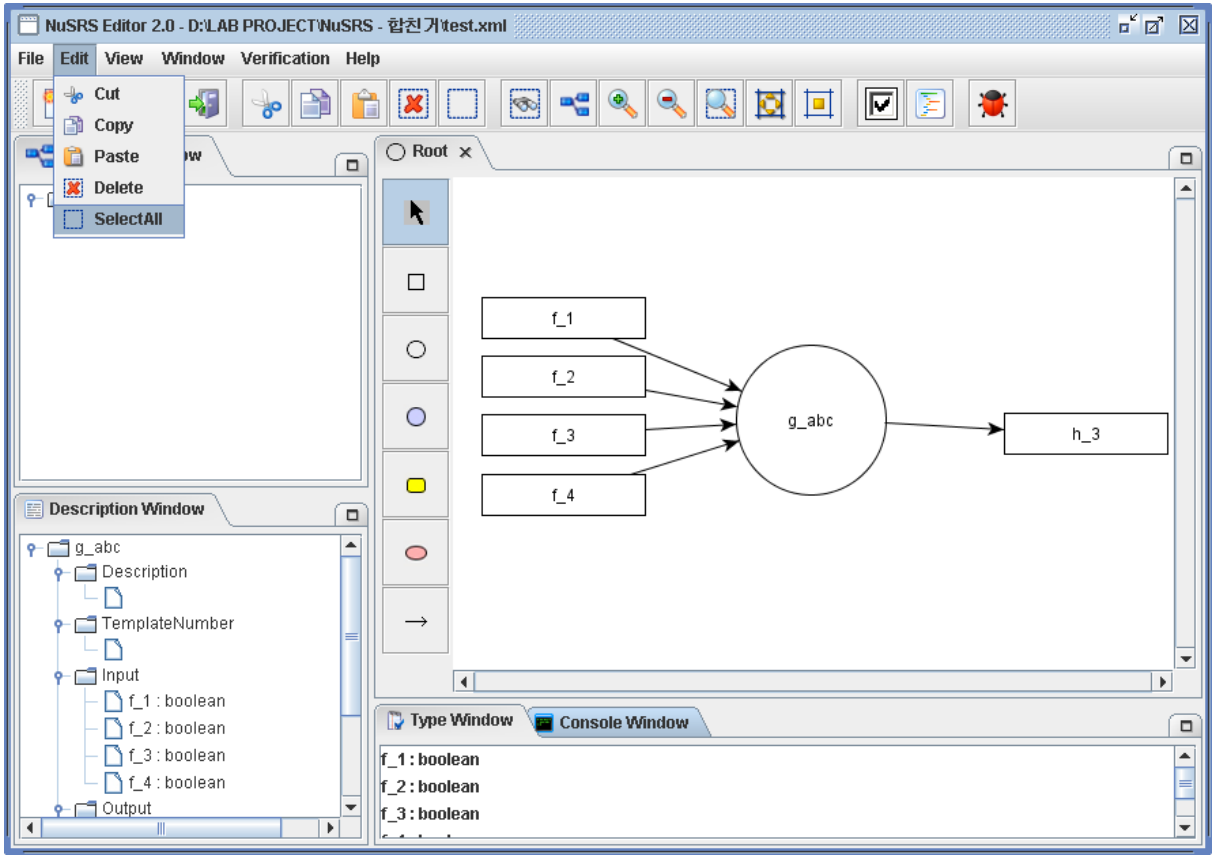
Edit > Delete (3/3)

3. Selection is deleted.



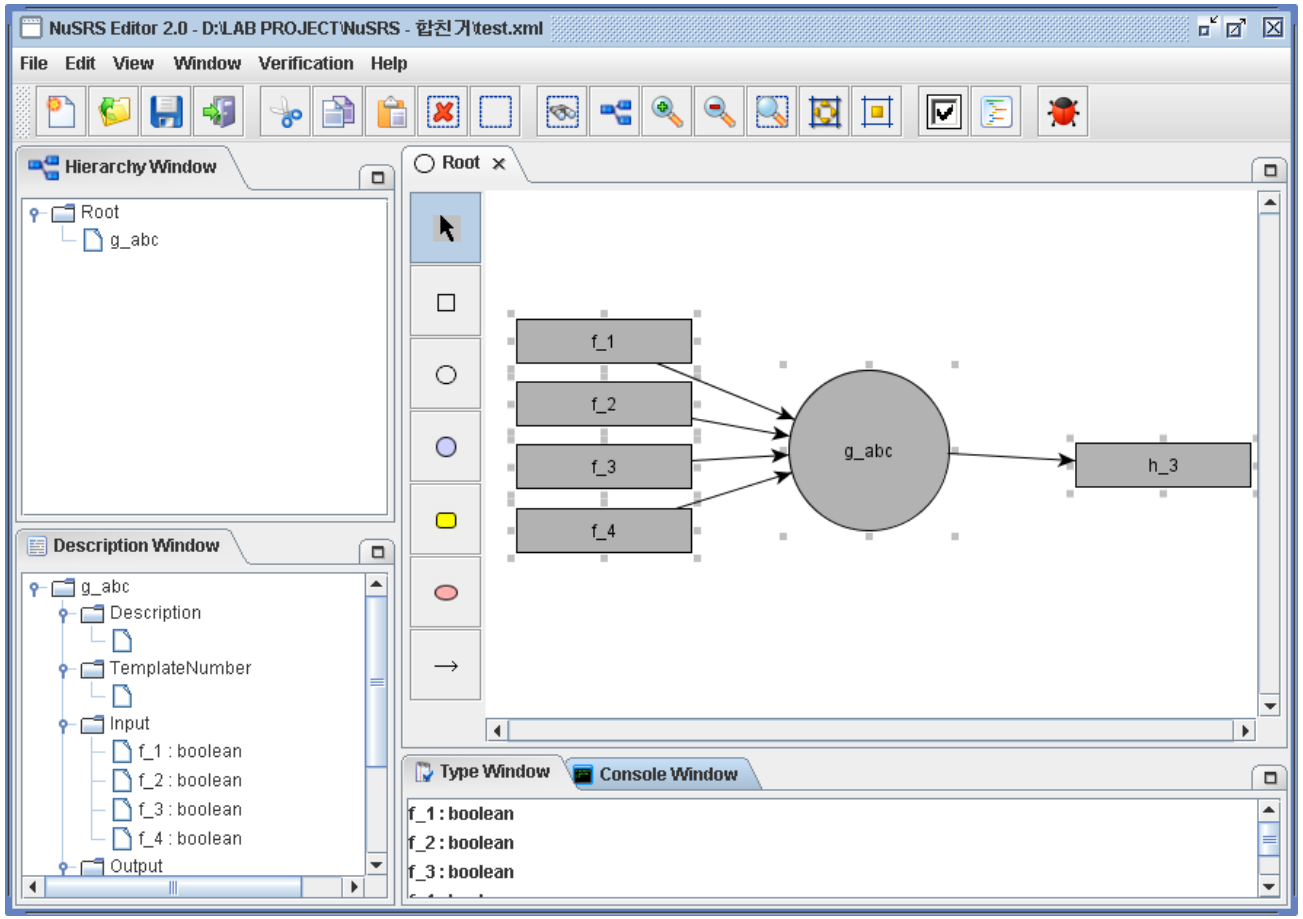
Edit > Select All (1/2)

1. Select Edit > Select All. (or press Ctrl + A)



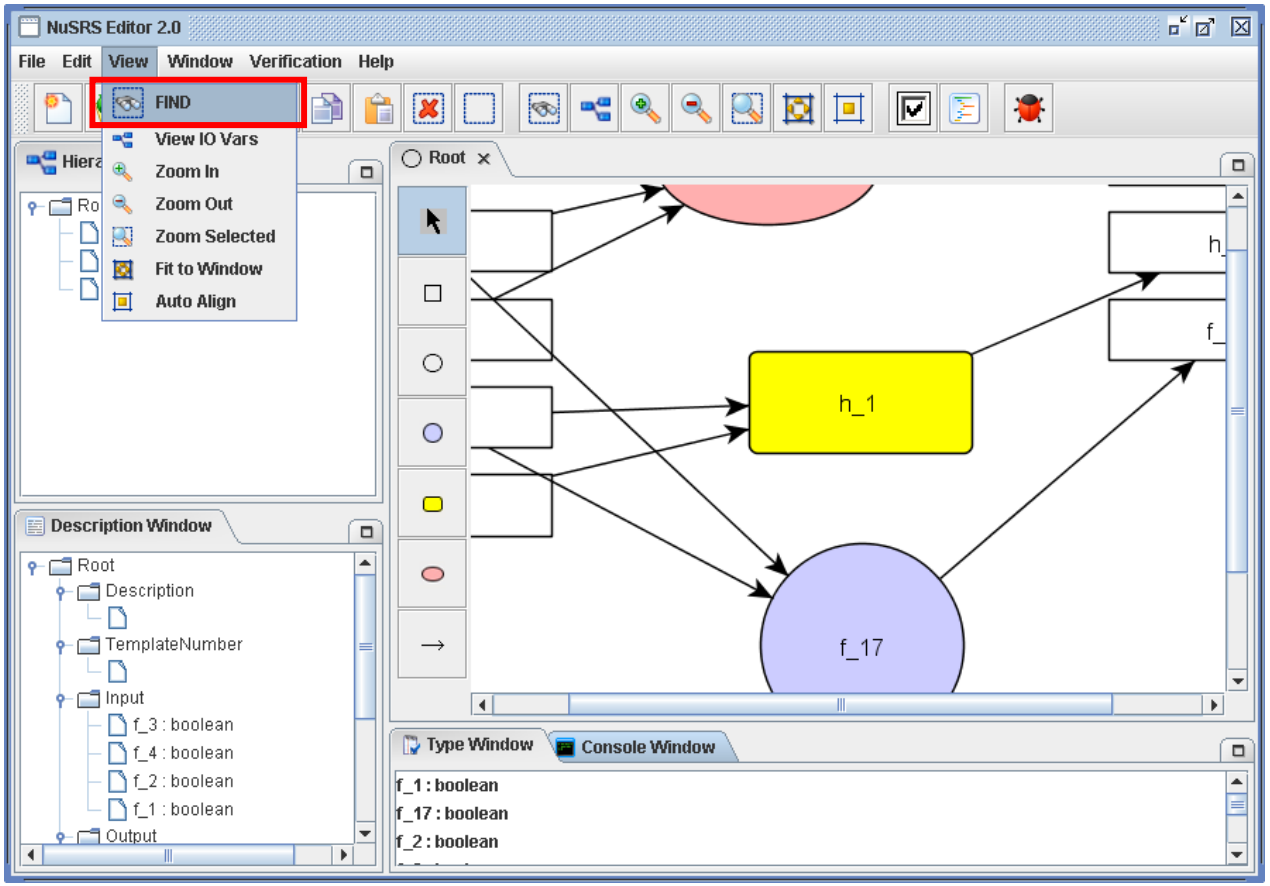
Edit > Select All (2/2)

2. All nodes in the current view are selected.



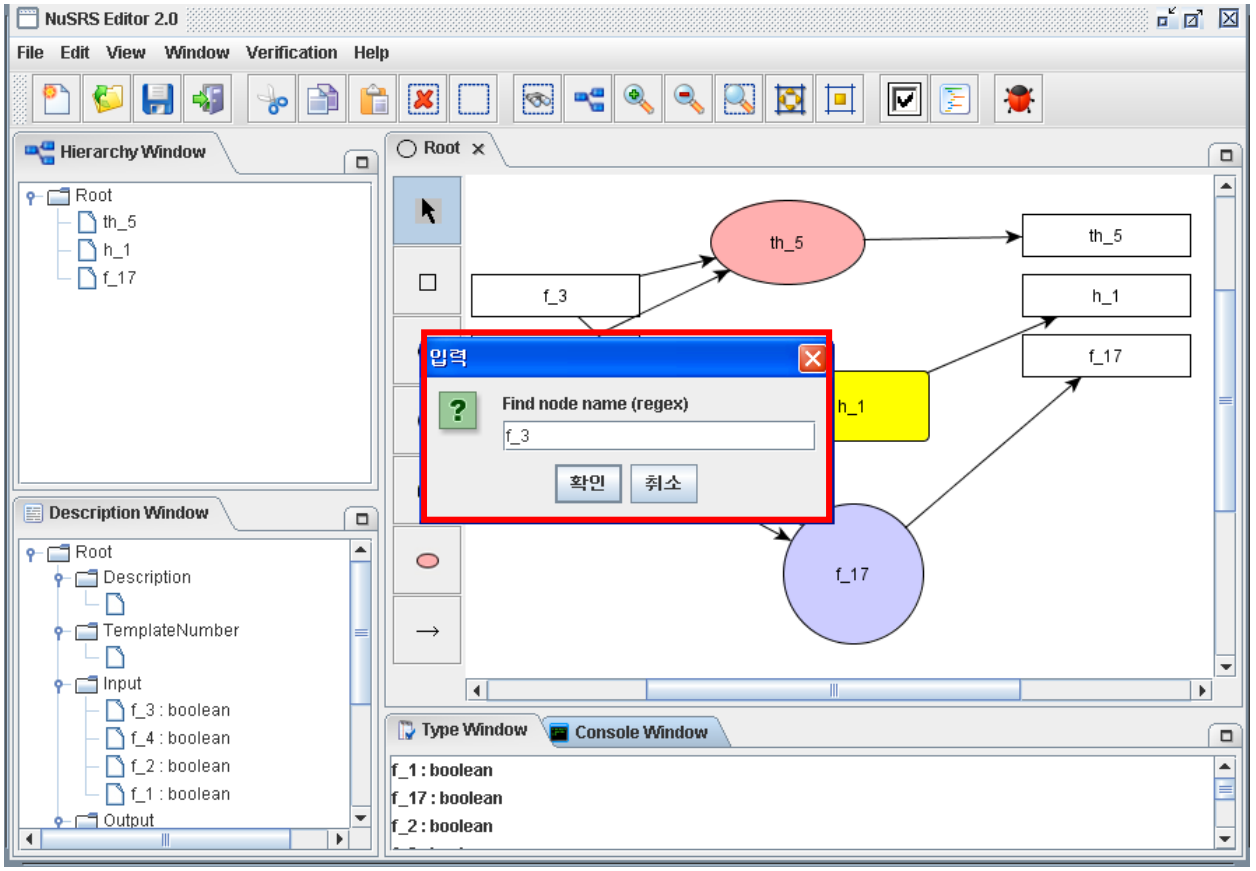
View > Find (1/3)

1. Select View > Find in Menu.



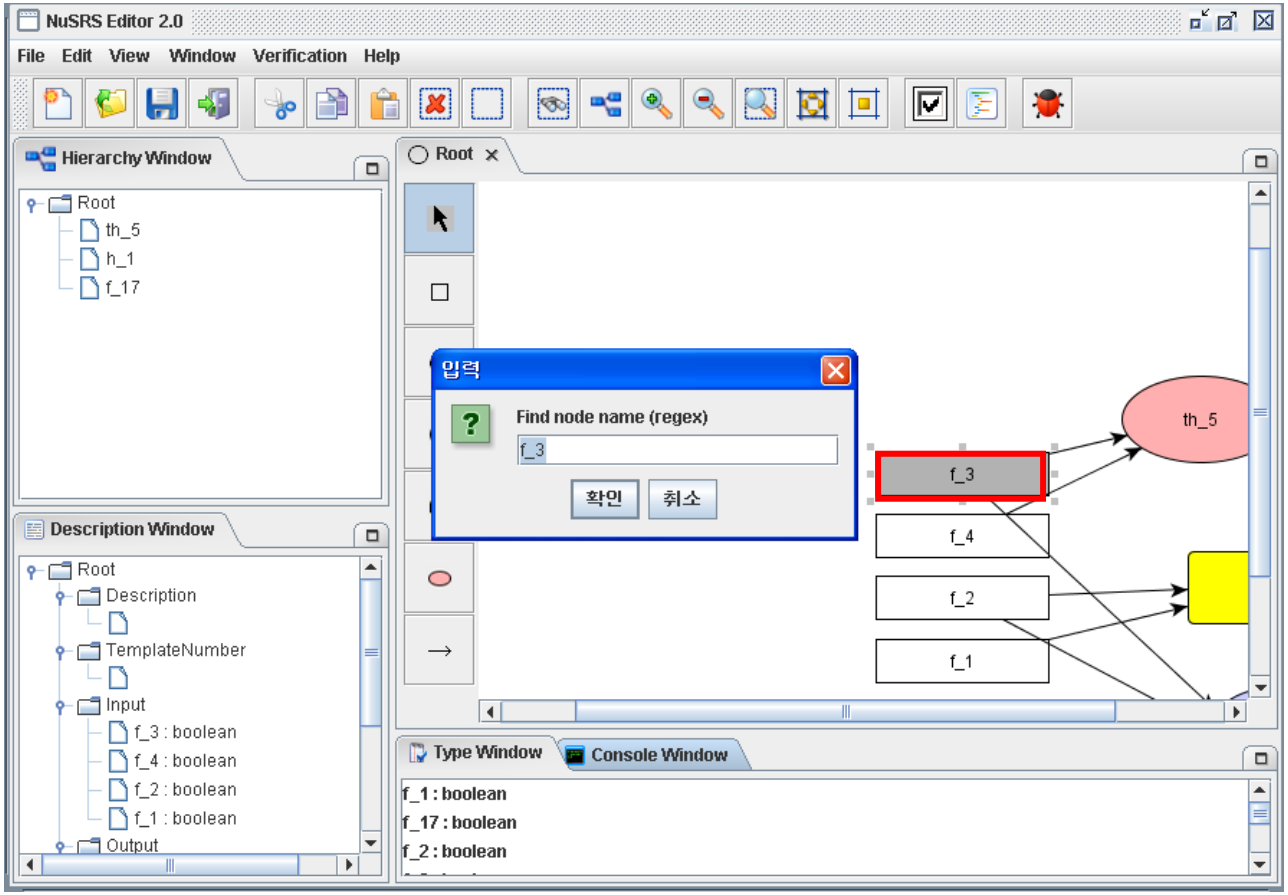
View > Find (2/3)

2. When the dialog appears, input the name of a node which users want to find.



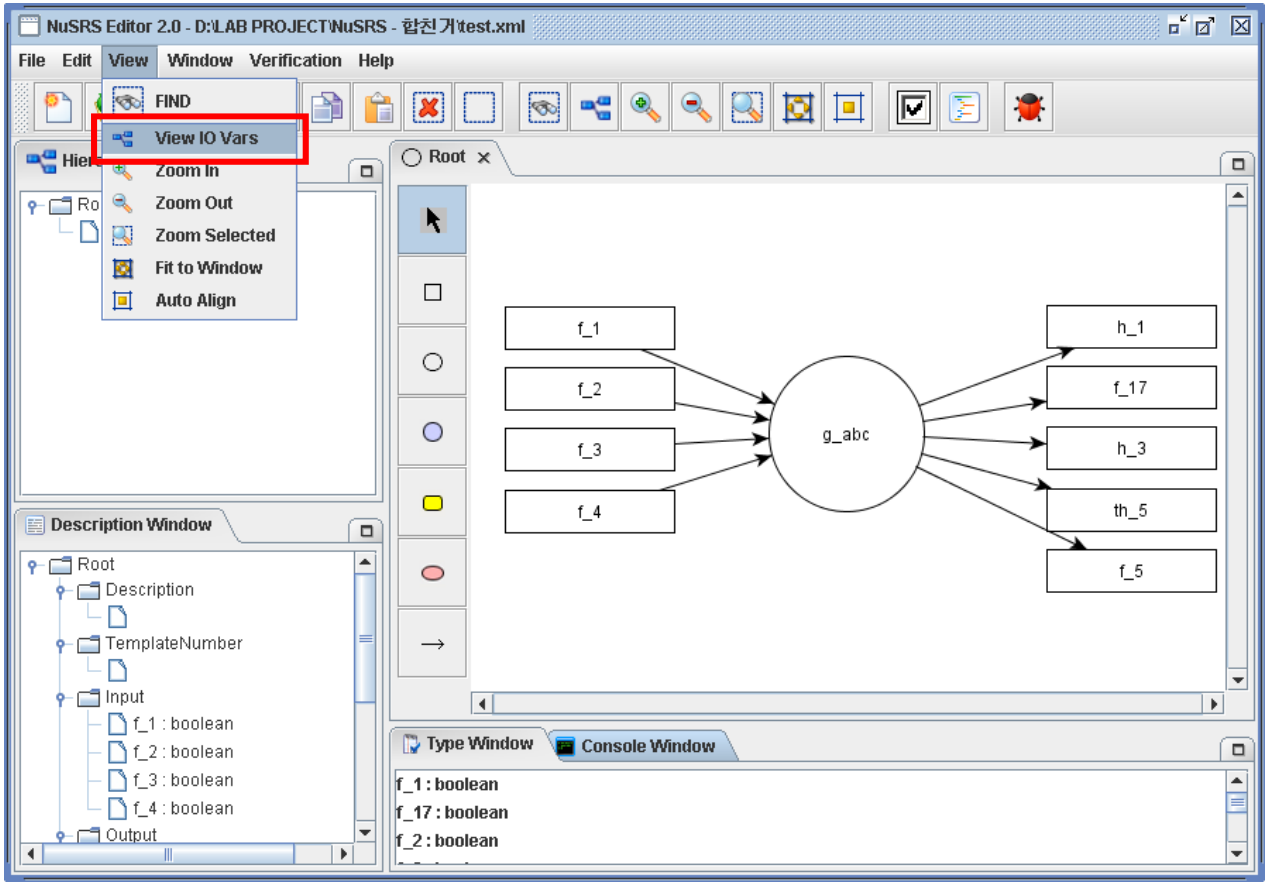
View > Find (3/3)

3. Focus moves to the found node.



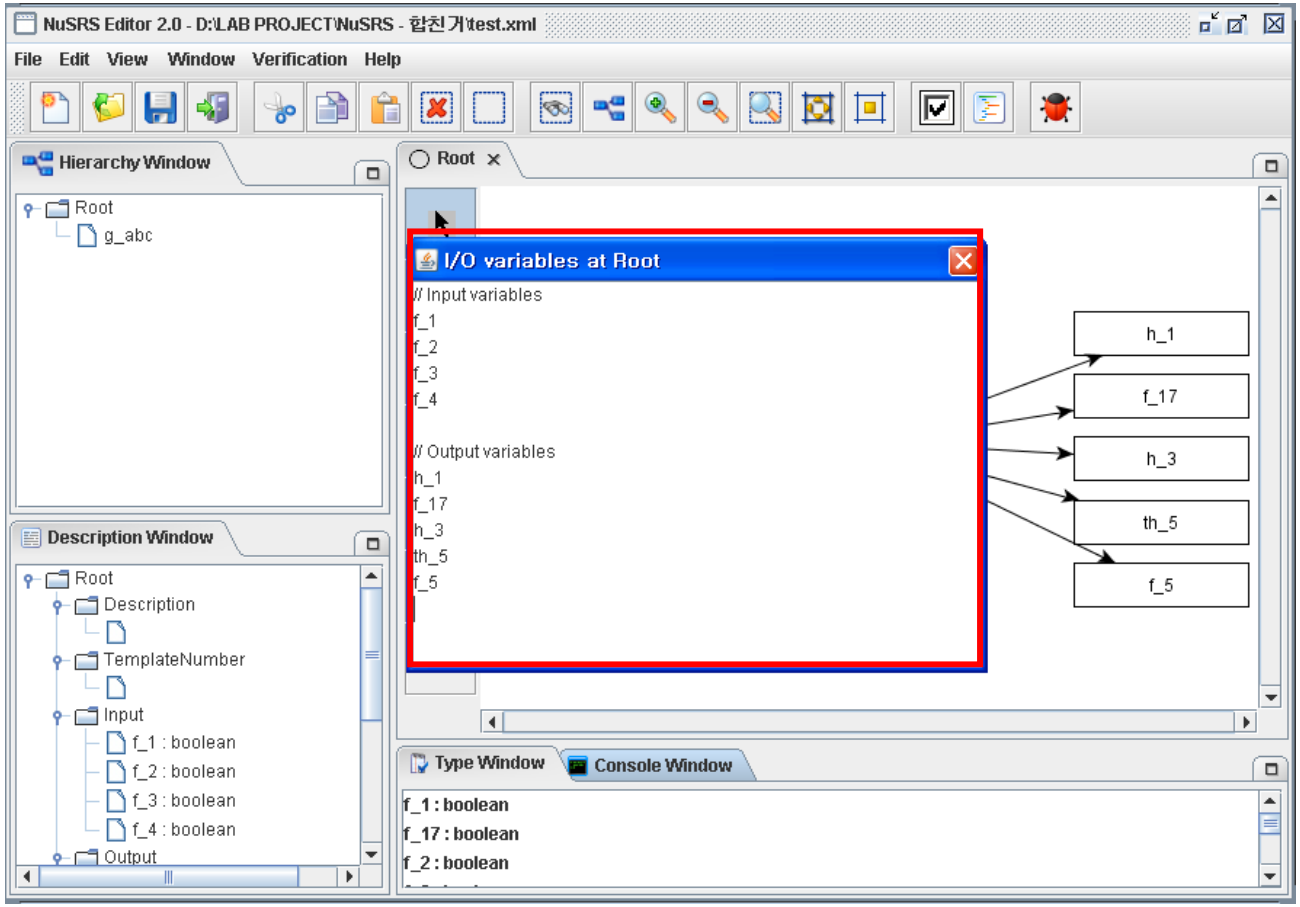
View > View I/O Vars (1/2)

1. Select View > View IO Vars in Menu.



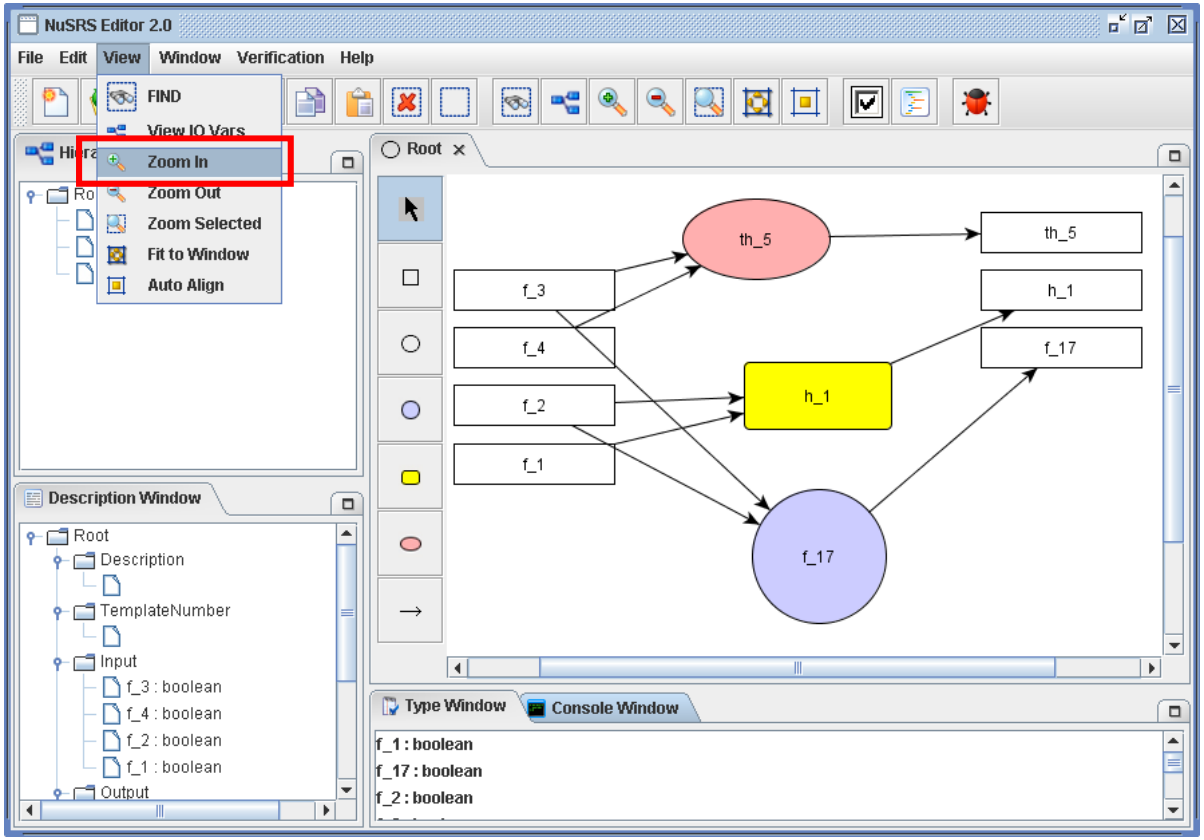
View > View I/O Vars (2/2)

2. List of I/O variables appears.



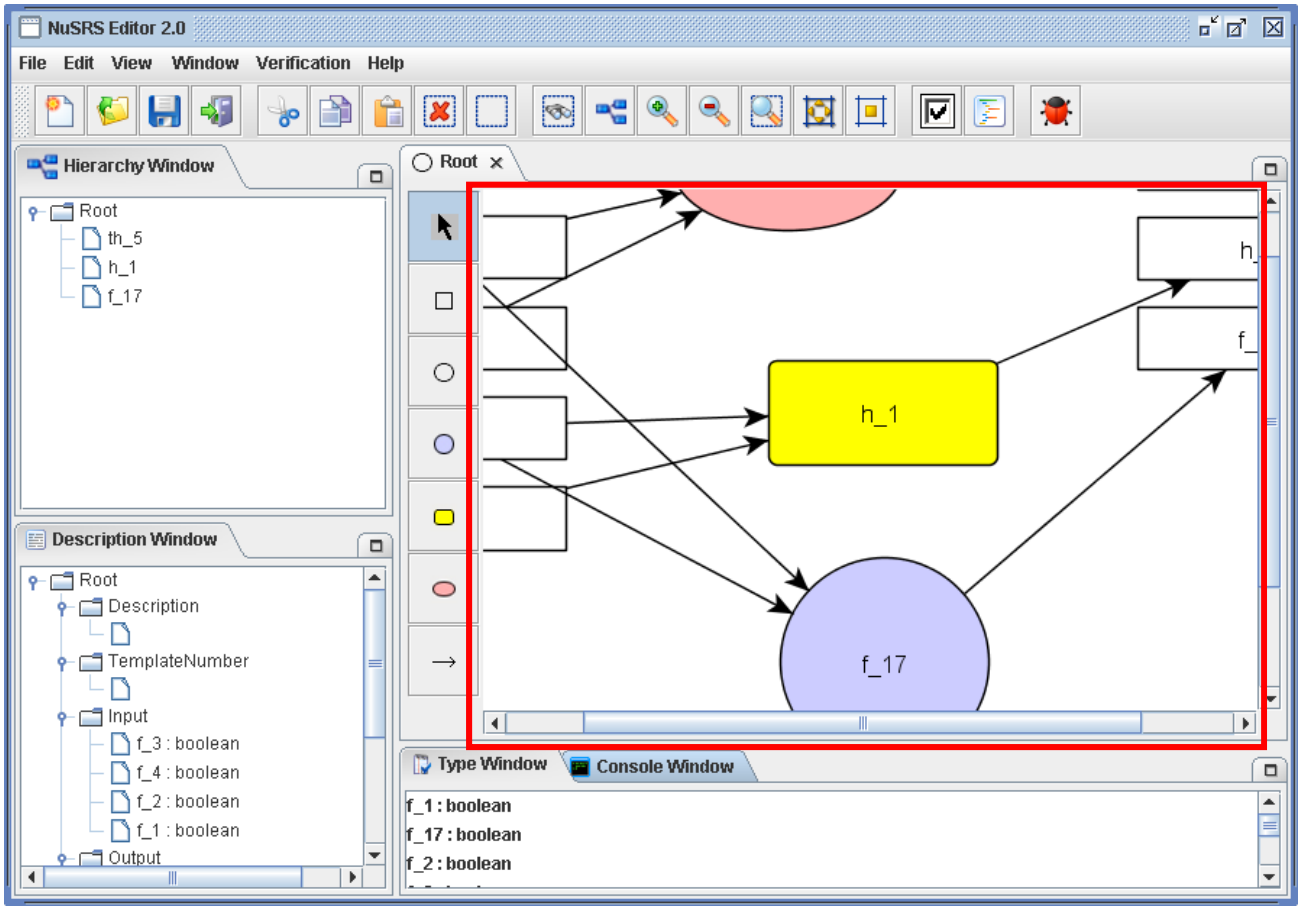
View > Zoom In (1/2)

1. Select View > Zoom In. (or press + in the keypad)



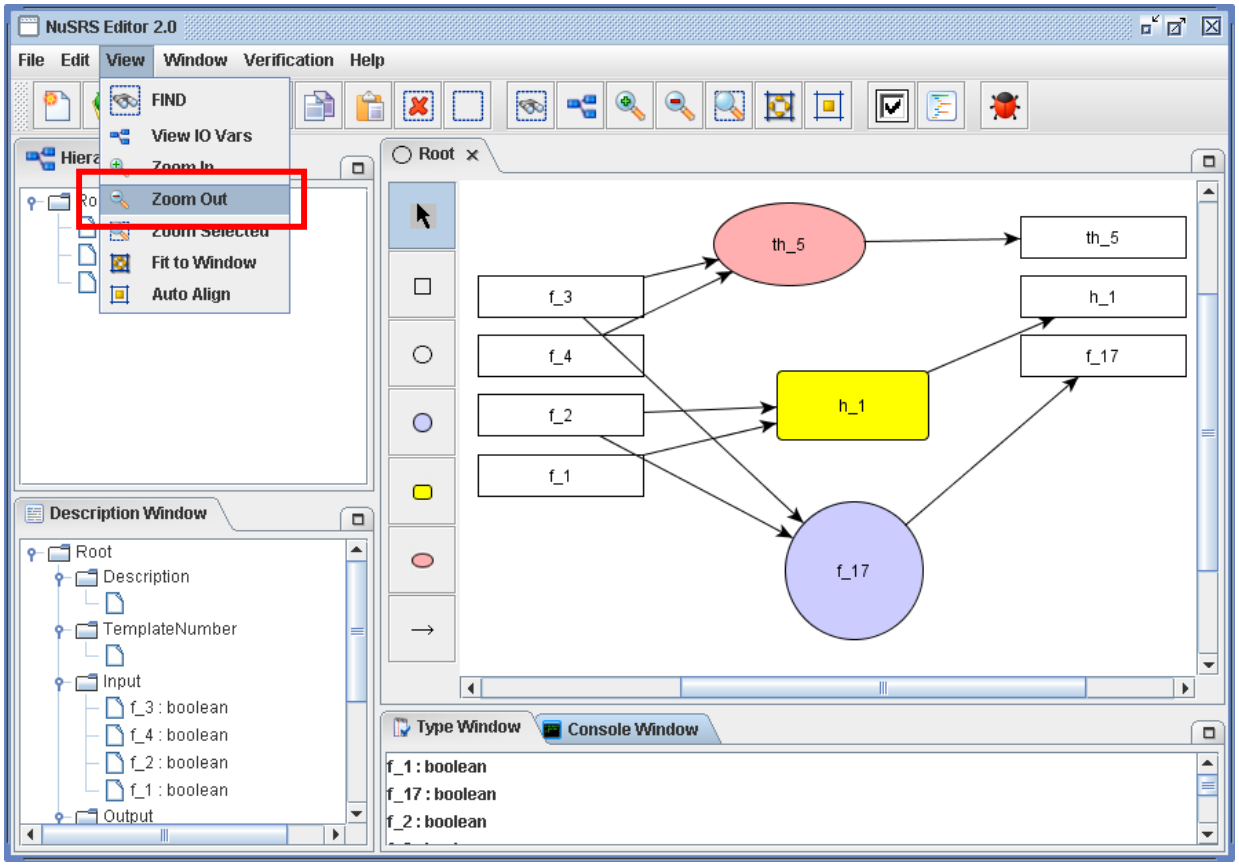
View > Zoom In (2/2)

2. Zoom in on the current active window.



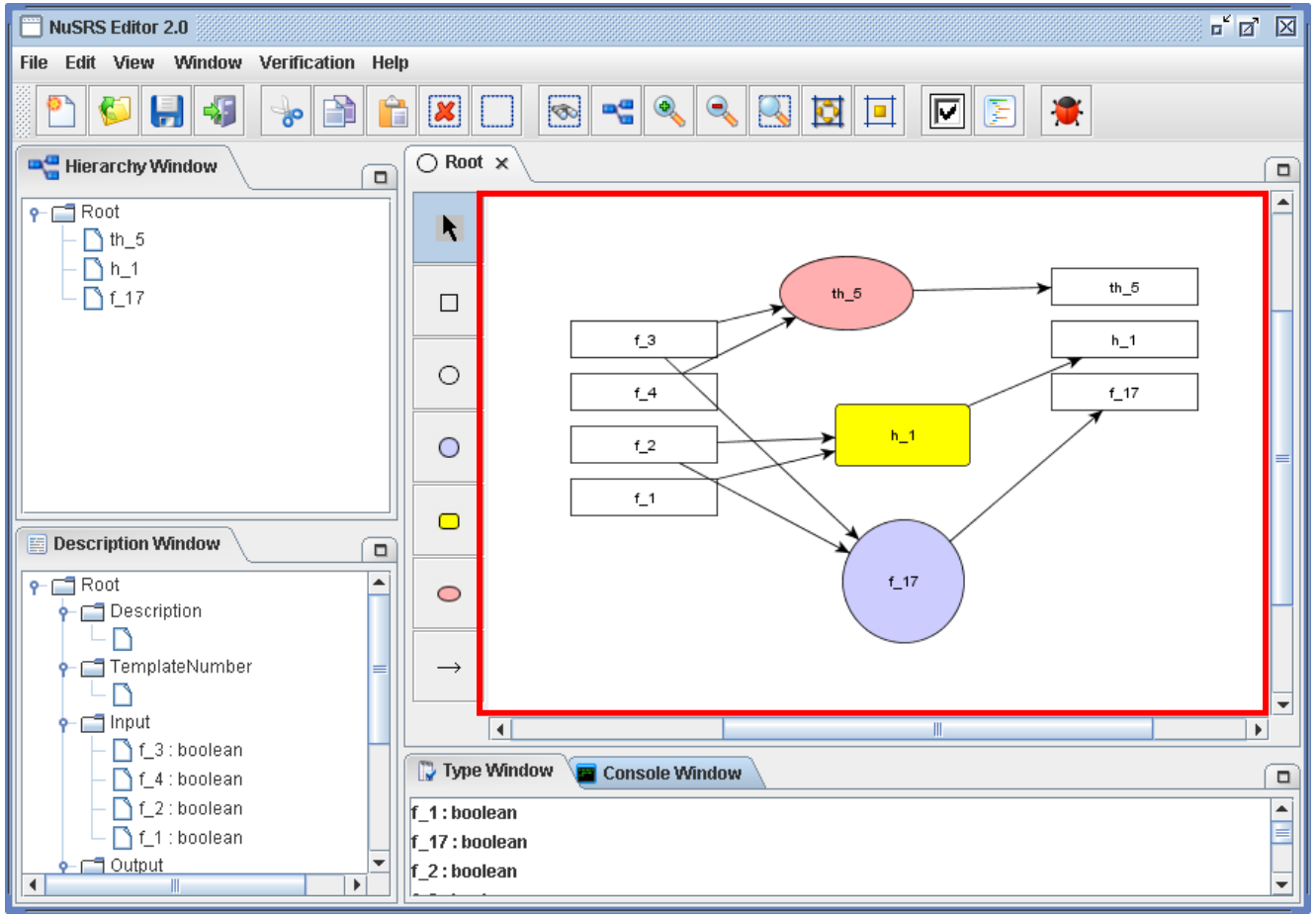
View > Zoom Out (1/2)

1. Select View > Zoom Out. (or press – in the keypad)



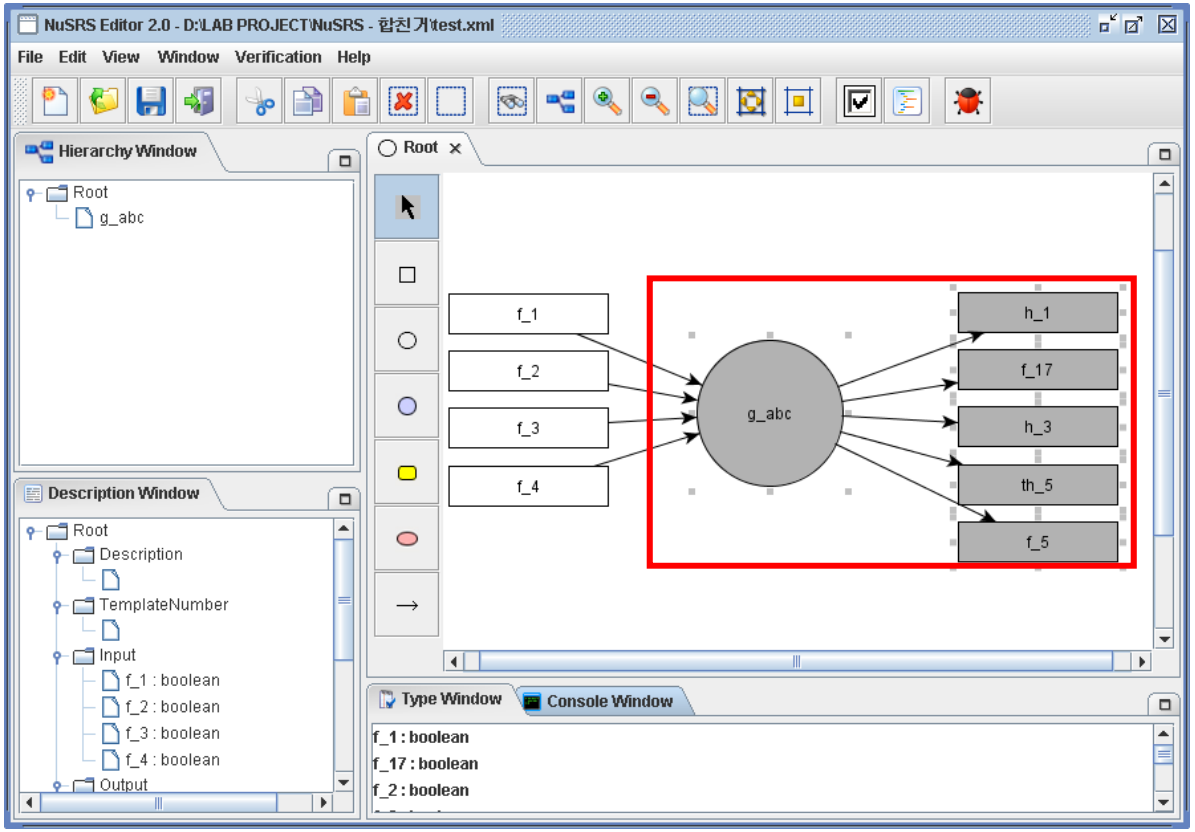
View > Zoom Out (2/2)

2. Zoom out of the current active window.



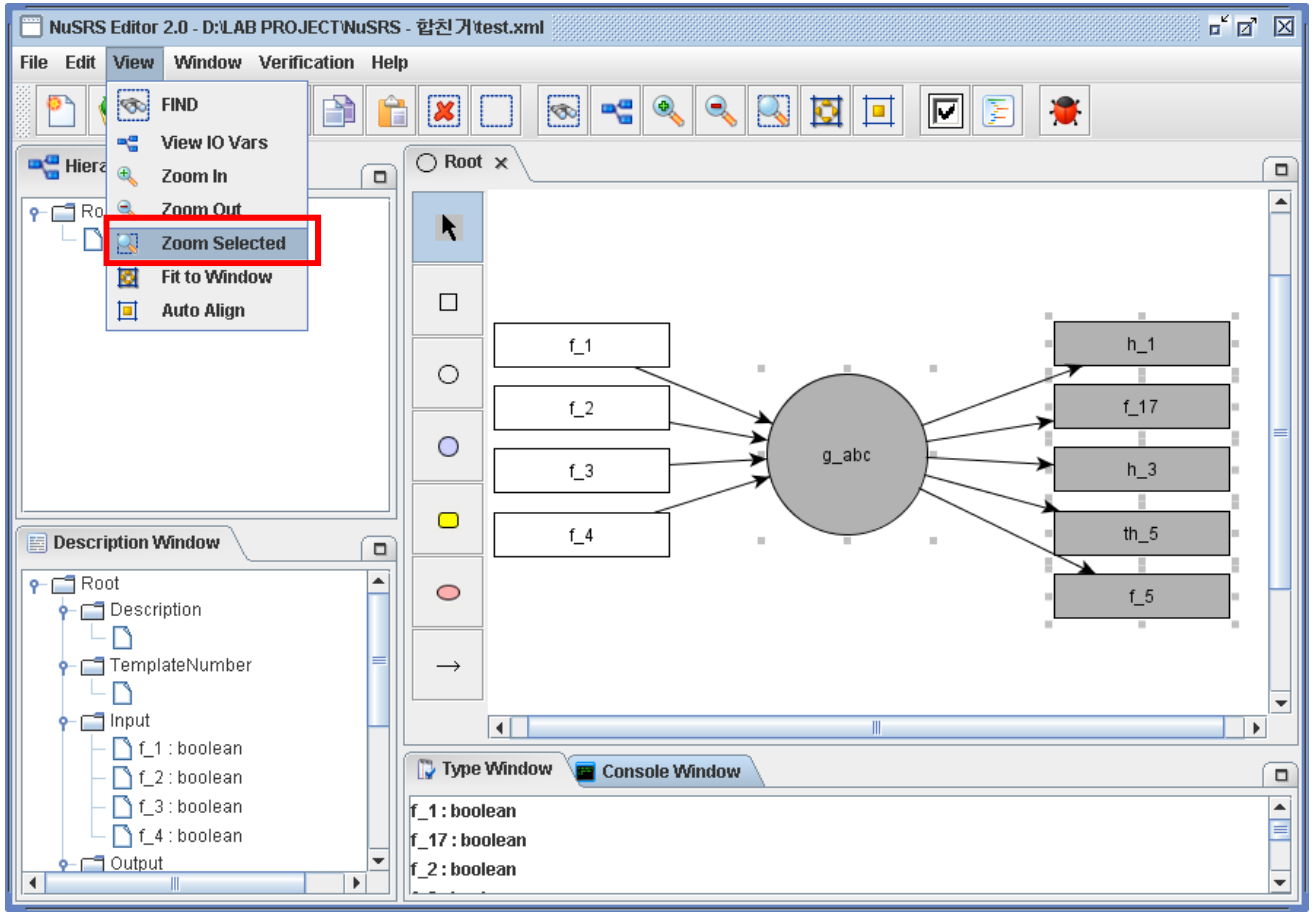
View > Zoom Selected (1/3)

1. Select the area to be zoomed by clicking the left mouse button or by drag & drop.



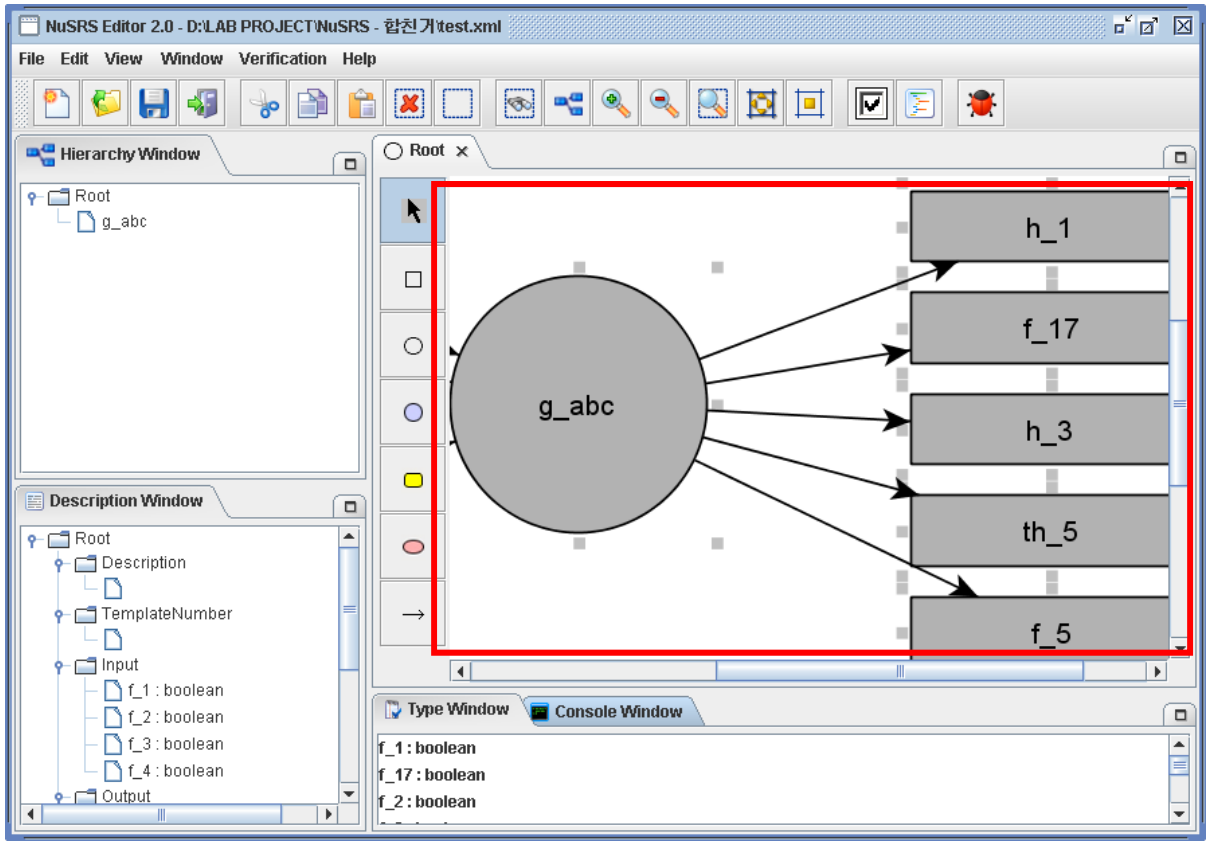
View > Zoom Selected (2/3)

2. Select View > Zoom Selected.



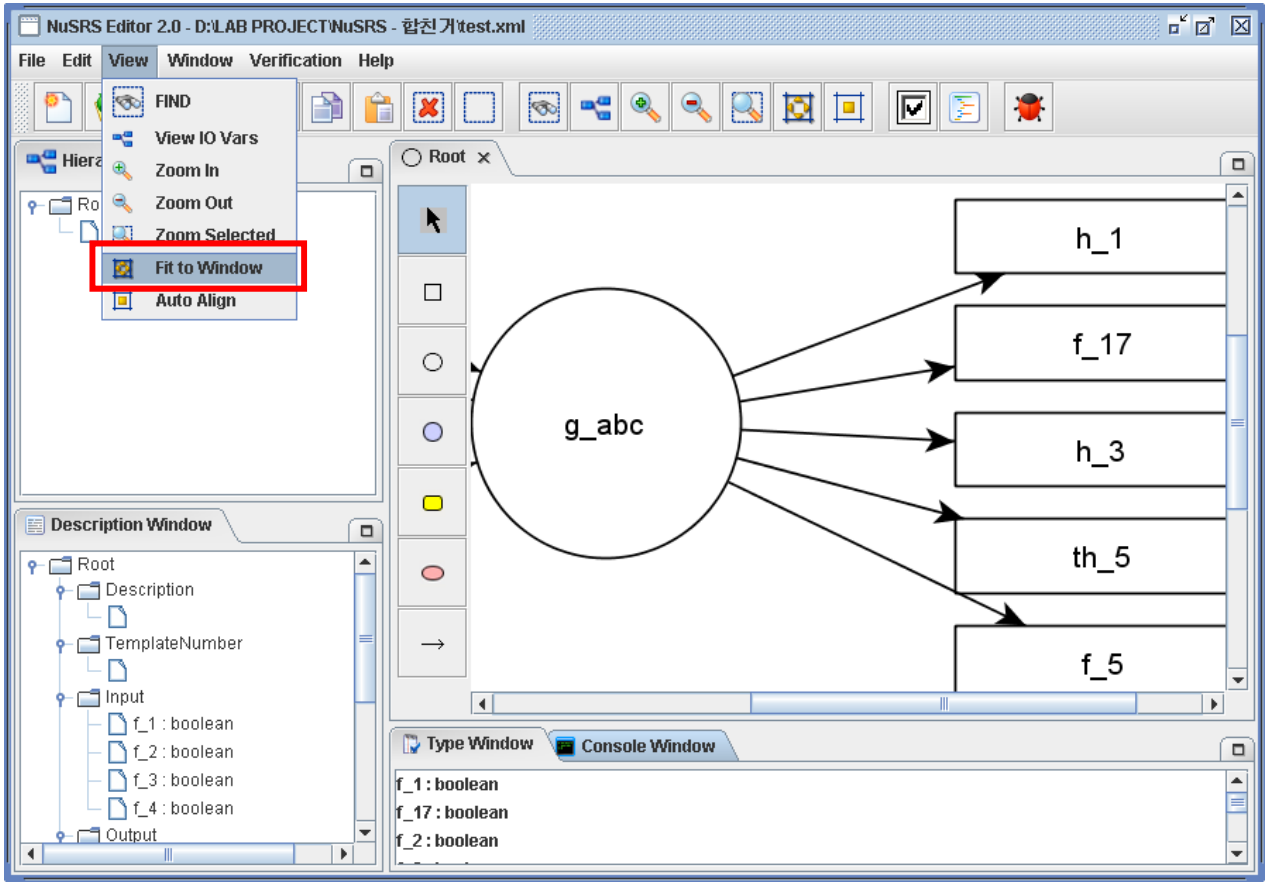
View > Zoom Selected (3/3)

3. The selected image is zoomed in to fill the current window space.



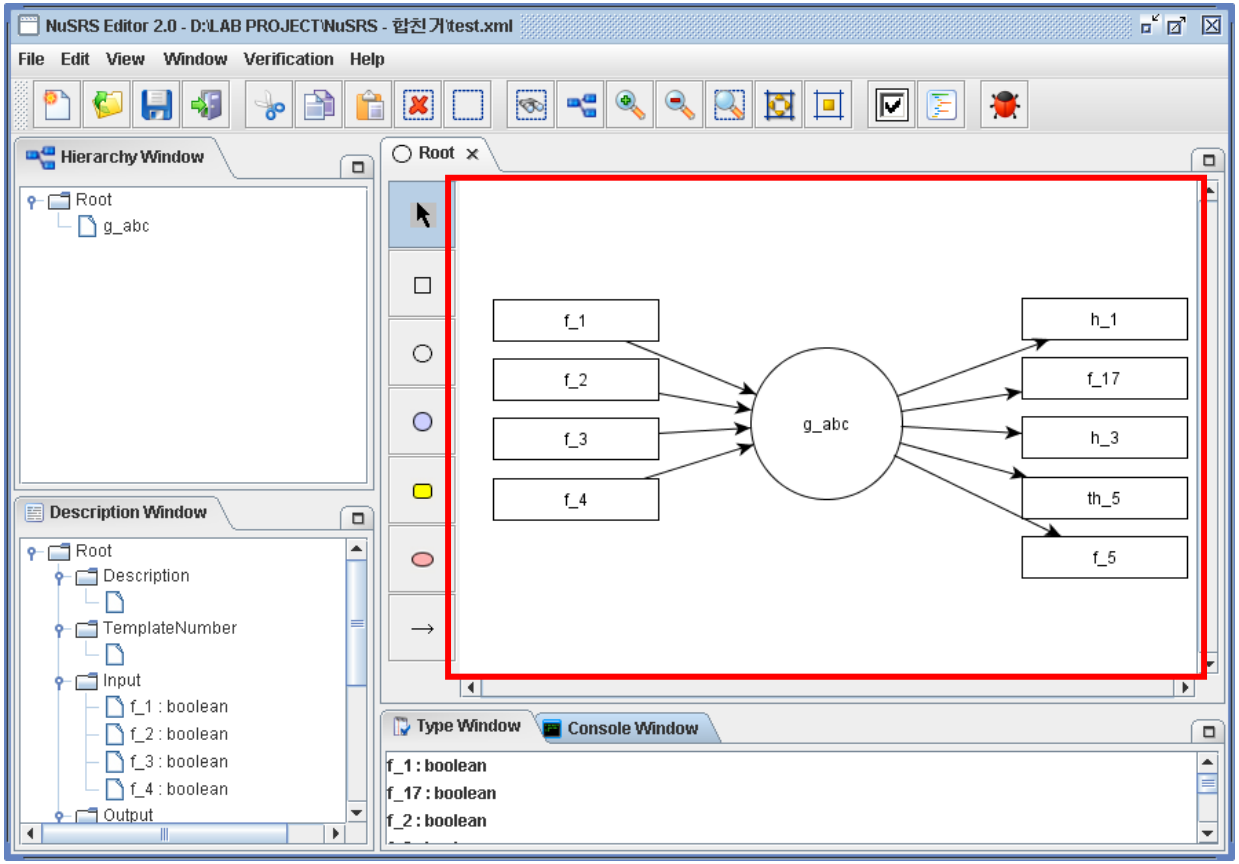
View > Fit to Window (1/2)

1. Select View > Fit to Window.



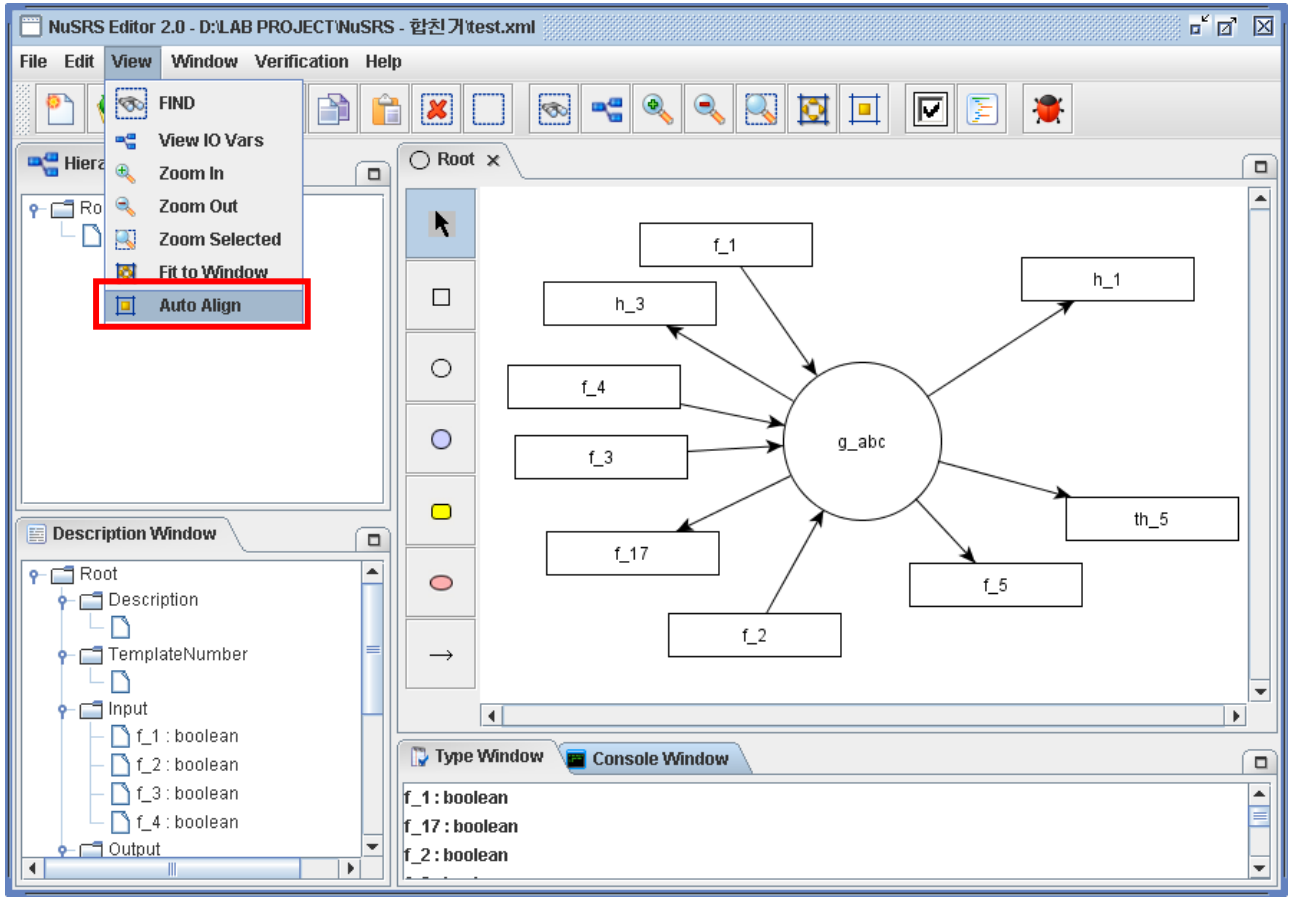
View > Fit to Window (2/2)

2. The current active image is adjusted to fit the window space.



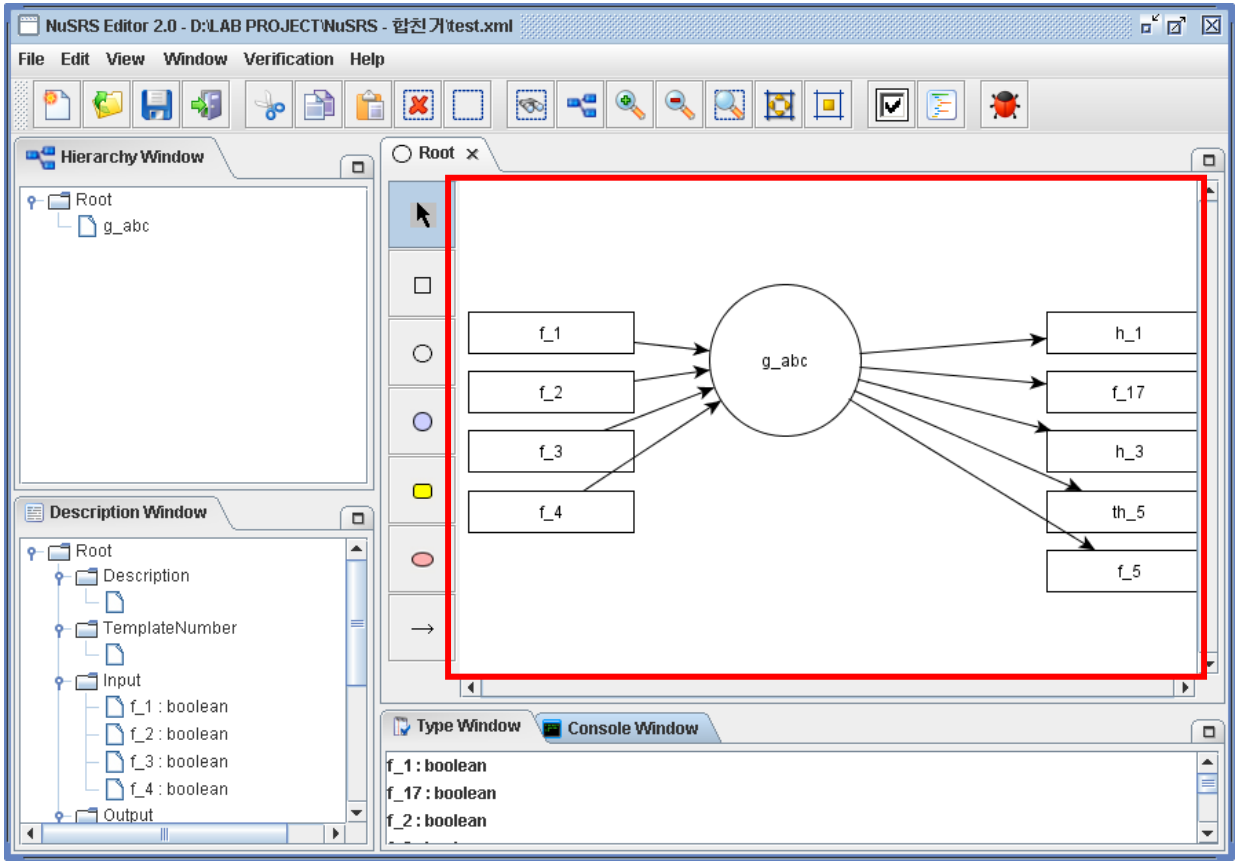
View > Auto Align (1/2)

1. Select View > Auto Align.



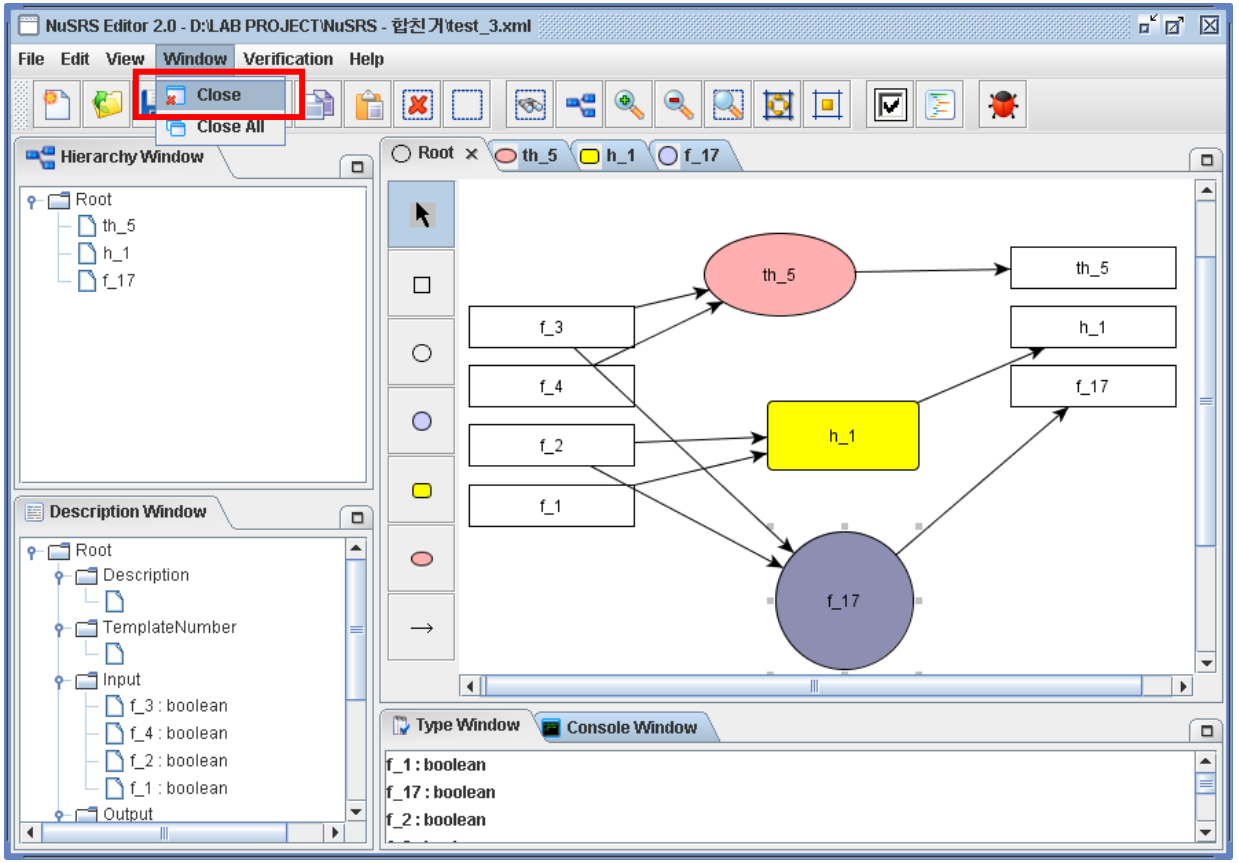
View > Auto Align (2/2)

2. Nodes and arrows in the current active window are automatically aligned and placed.



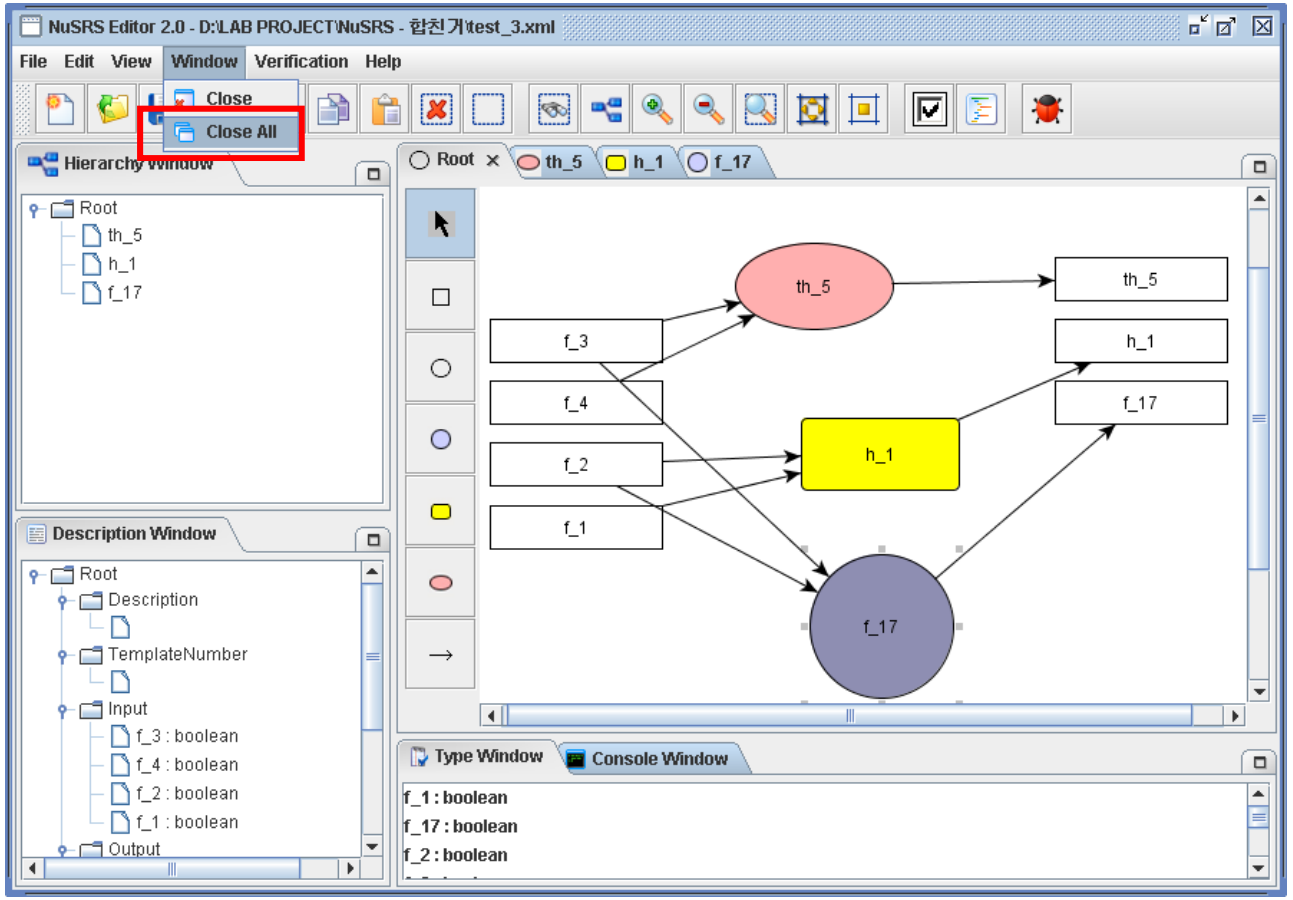
Close Window

1. Select Window > Close. The current active window is then closed.



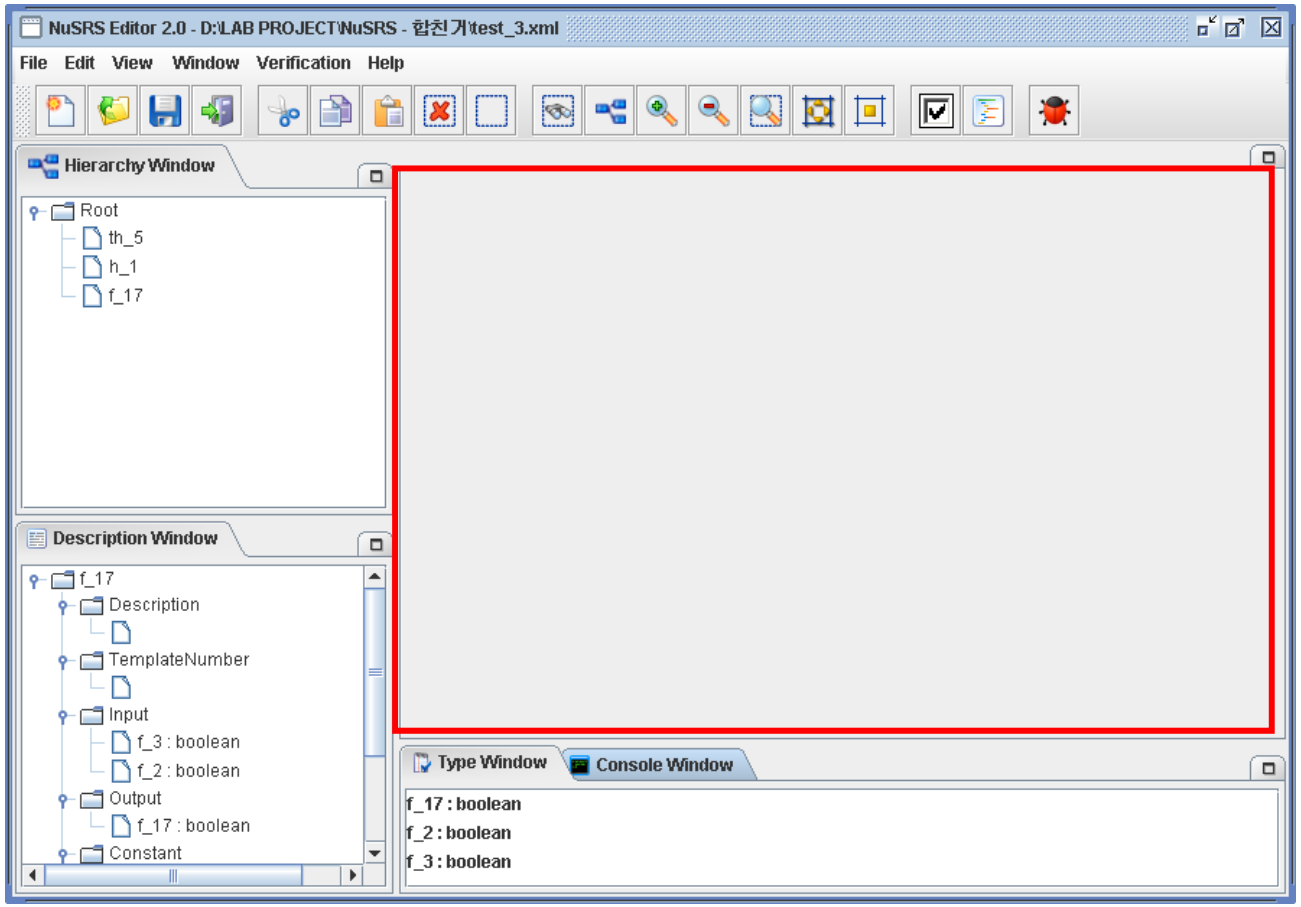
Close all Windows (1/2)

1. Select Window > Close All.



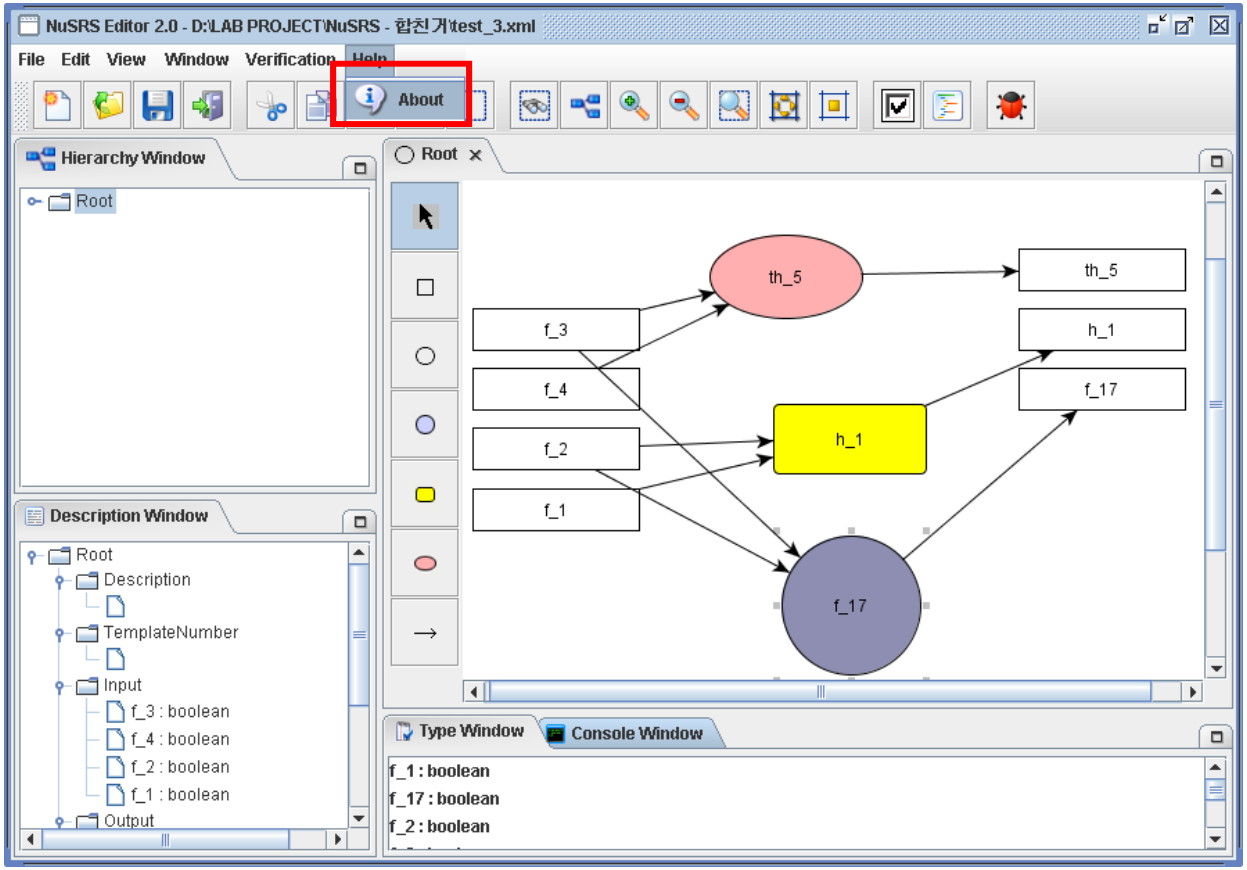
Close all Windows (2/2)

2. All open windows are then closed.



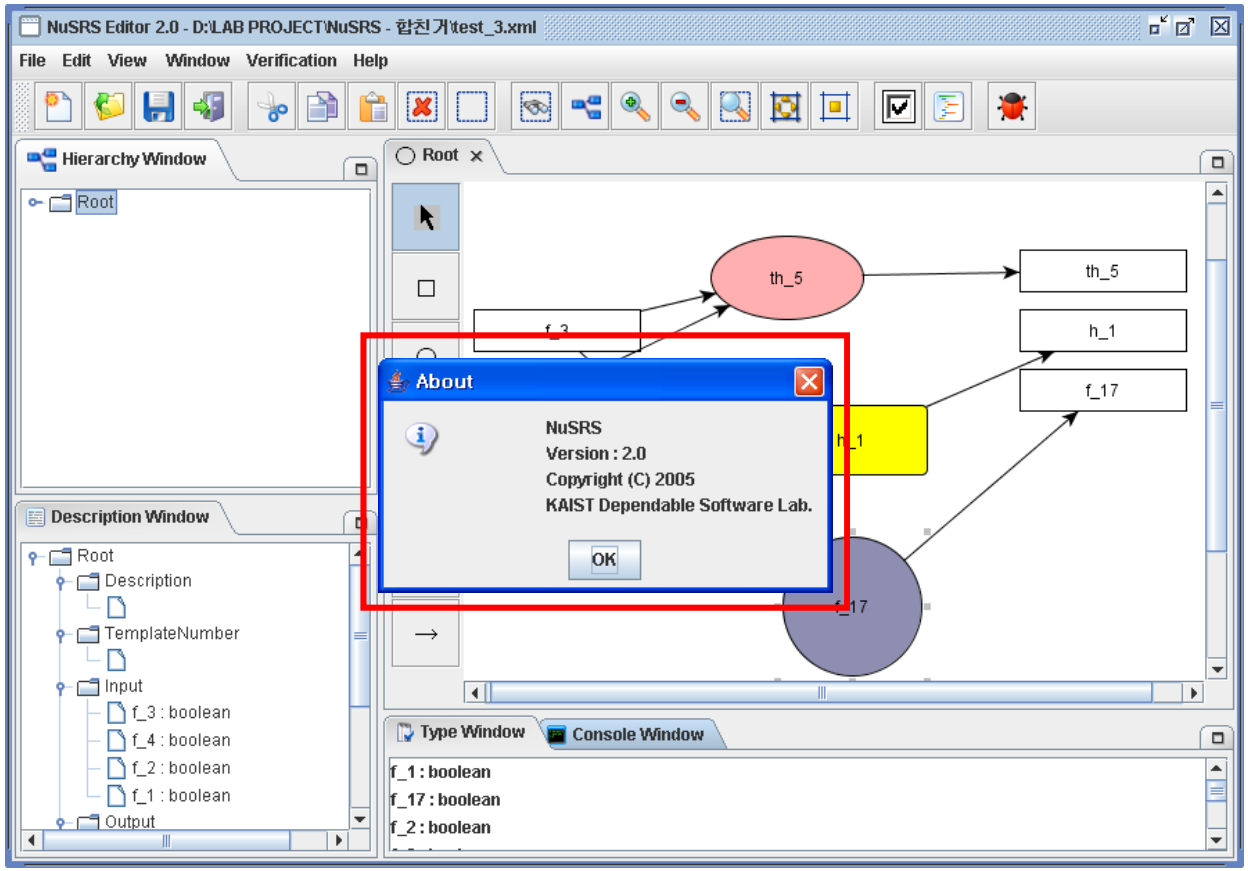
Inquire Program Information (1/2)

1. Select Help > About.

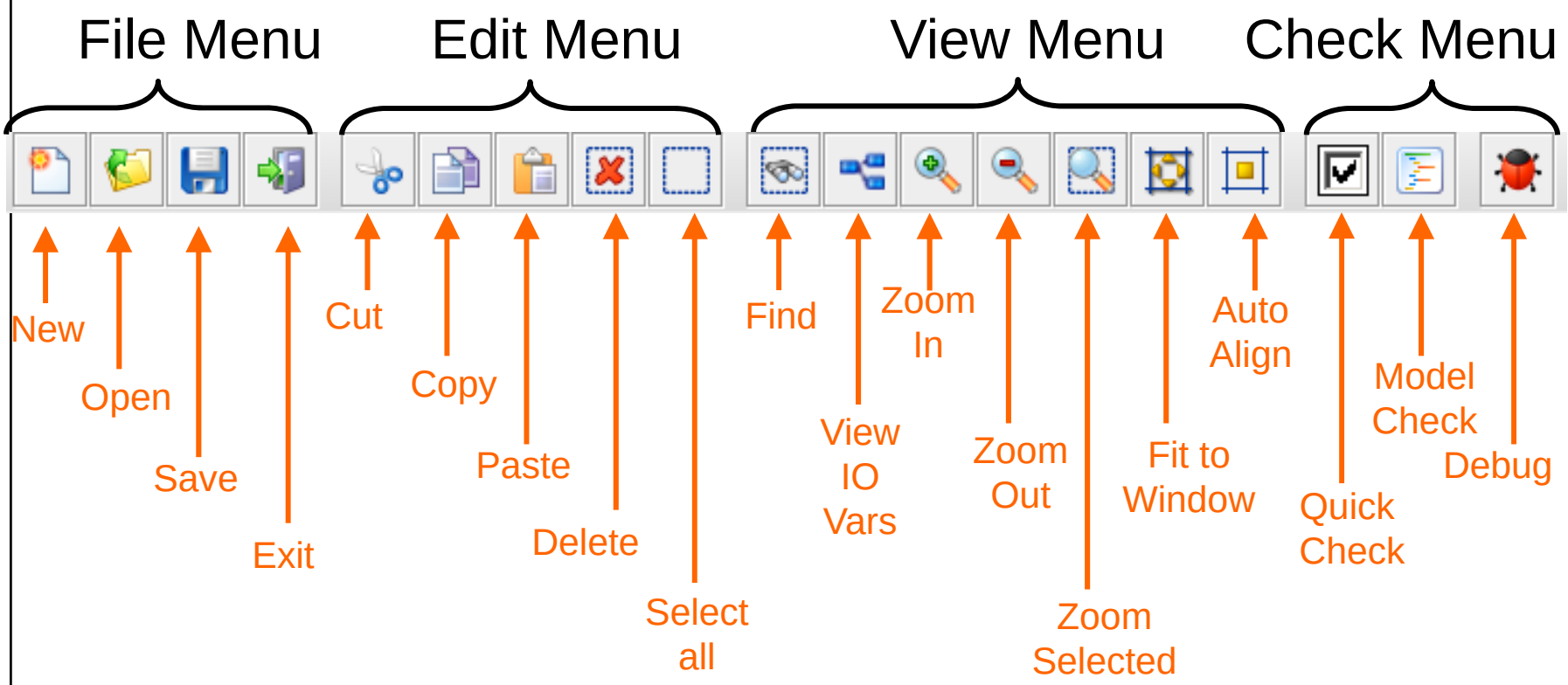


Inquire Program Information(2/2)

2. Information of the NuSRS program is given.

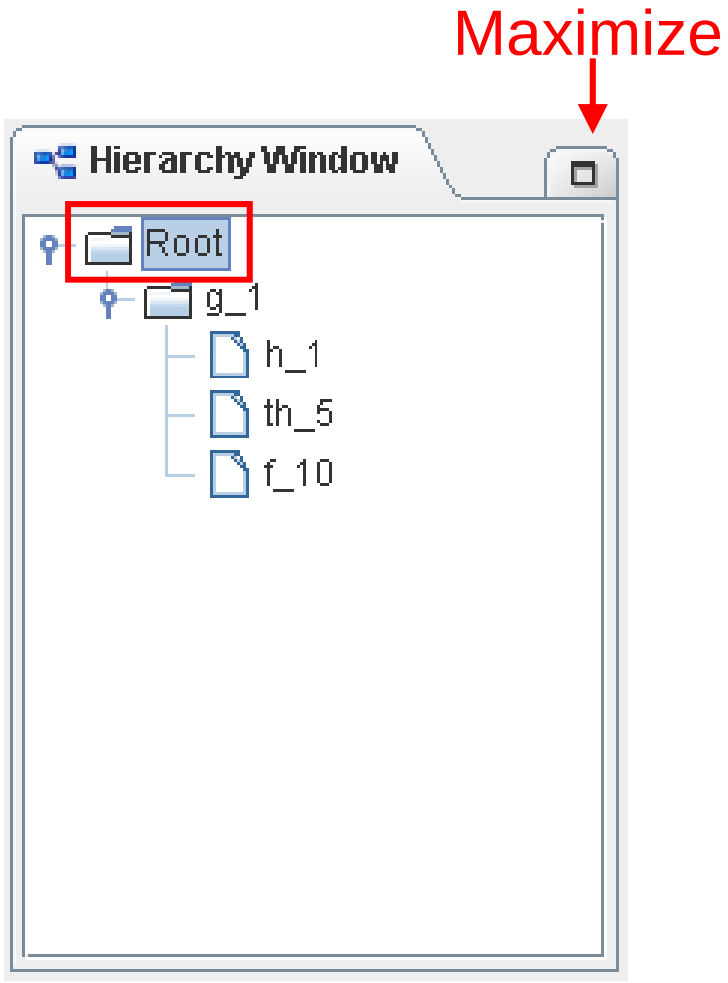


Toolbar


File Menu
Edit Menu
View Menu
Check Menu
New
Open
Save
Exit
Cut
Copy
Paste
Delete
Select all
Find
View IO Vars
Zoom In
Zoom Out
Zoom Selected
Fit to Window
Auto Align
Quick Check
Model Check
Debug

Hierarchy Window

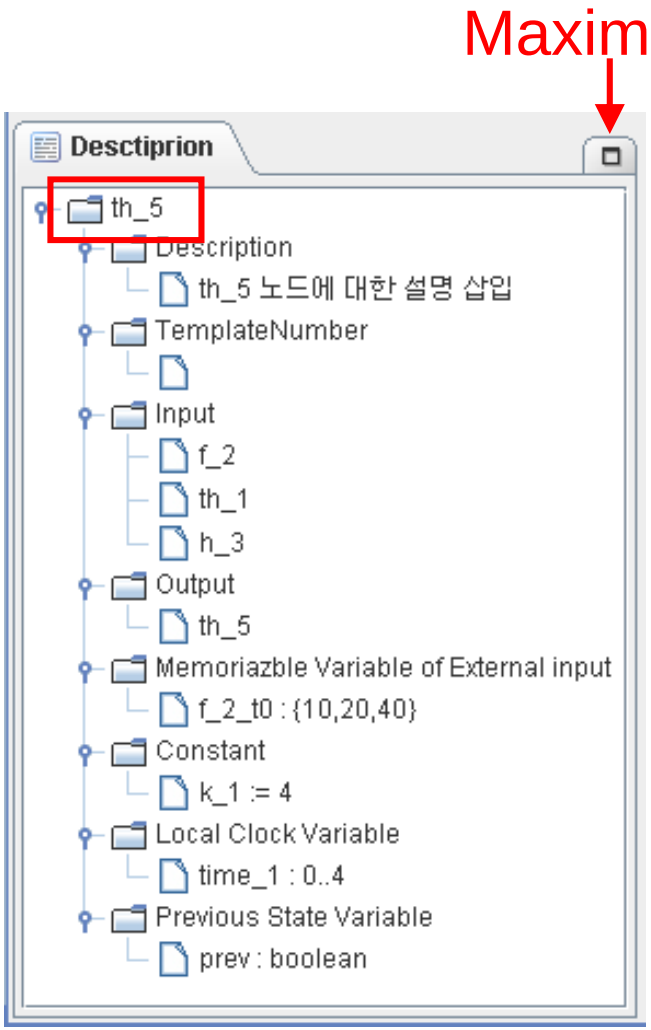
Hierarchy Window



- Hierarchy Window shows the hierarchical structure of the opened file
- Root is the highest FOD.
- By double clicking a tree branch, the corresponding FOD is opened or becomes active.
- Maximize button

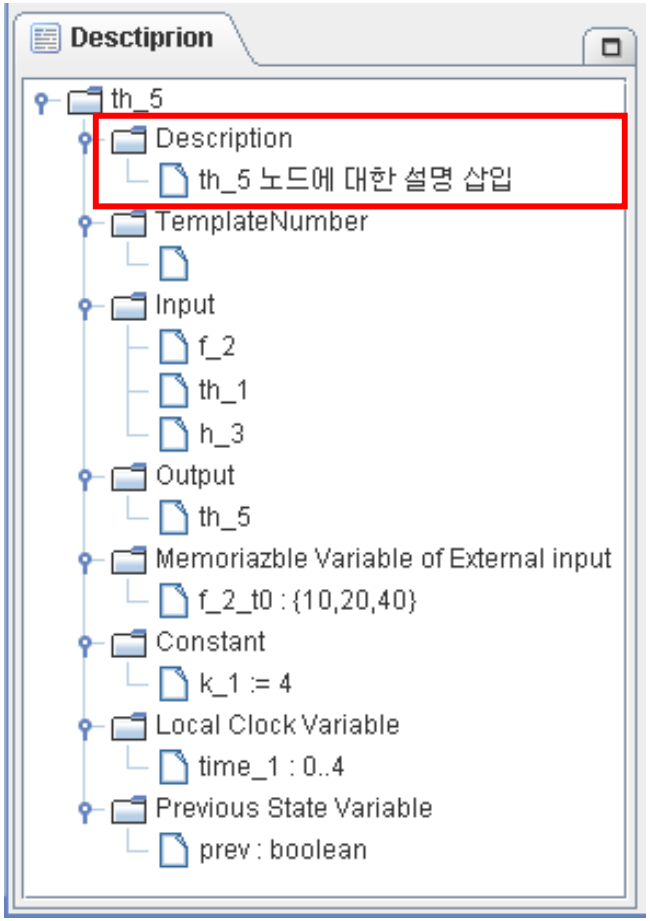
Description Window

Description (1/9)



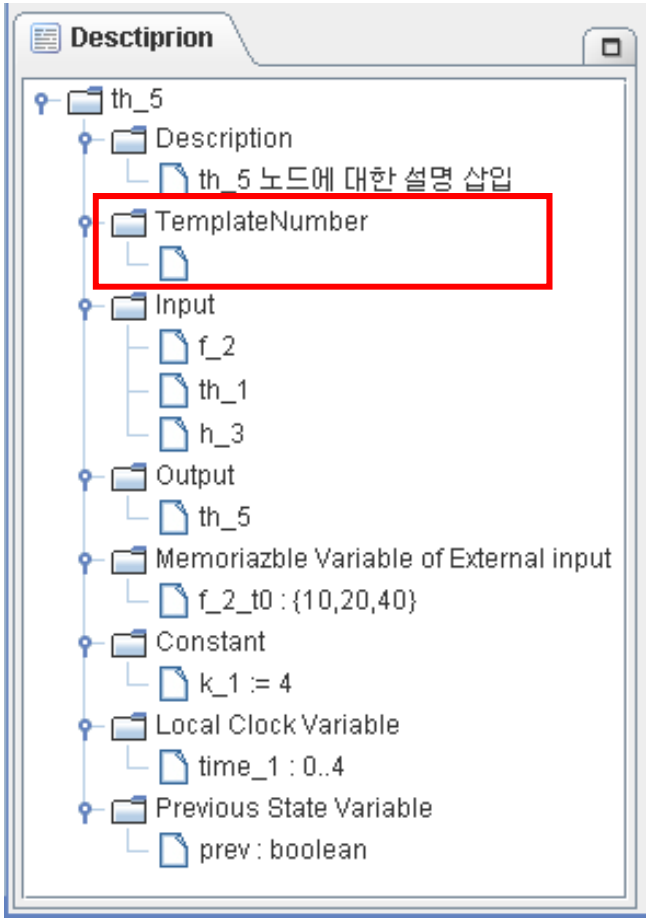
- Gives detailed description of the current active window.
- FOD name
  - Description window has the current active window's name (node name) as the root.
- Maximize Button

Description (2/9)



- Description
  - Shows information of the current active diagram
  - The node can be edited by double clicking the paper shaped icon.
  - (Applies to all FOD, SDT, FSM, TTS)

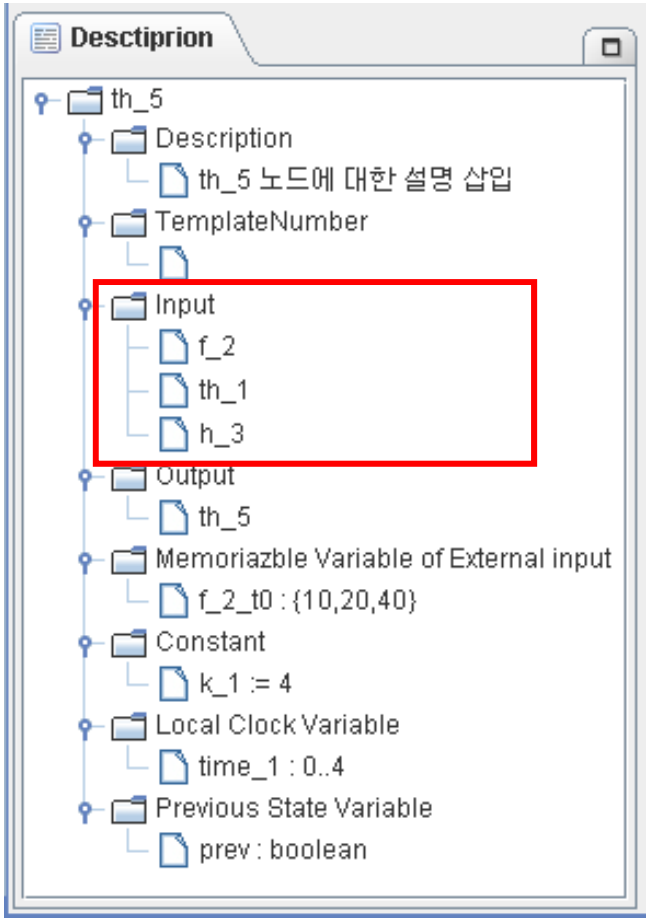
Description (3/9)



- Template Number
  - Logic represented by FSM or TTS has a certain type of template. Input the corresponding template number.
  - The node can be edited by double clicking the paper shaped icon.
  - (Applies only to FSM, TTS)

KAIST

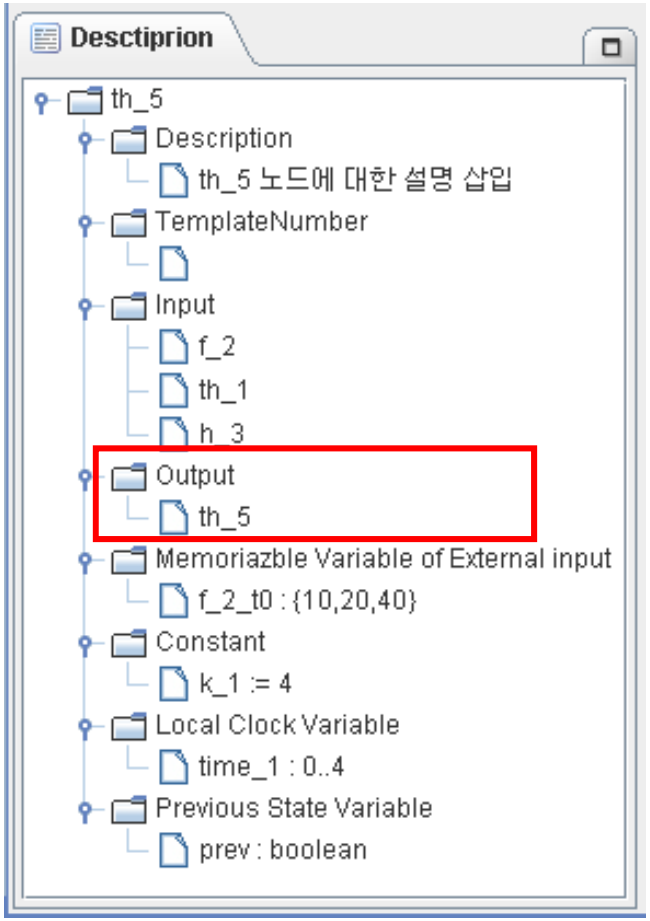
Description (4/9)



- Input
  - Shows all the input variables of the current active window.
  - Impossible to make direct changes in the description window.
  - When the input variable name in the parent FOD is changed, the same variable in the child FOD is automatically adjusted.
  - (Applies to all FOD, SDT, FSM, TTS)

KAIST

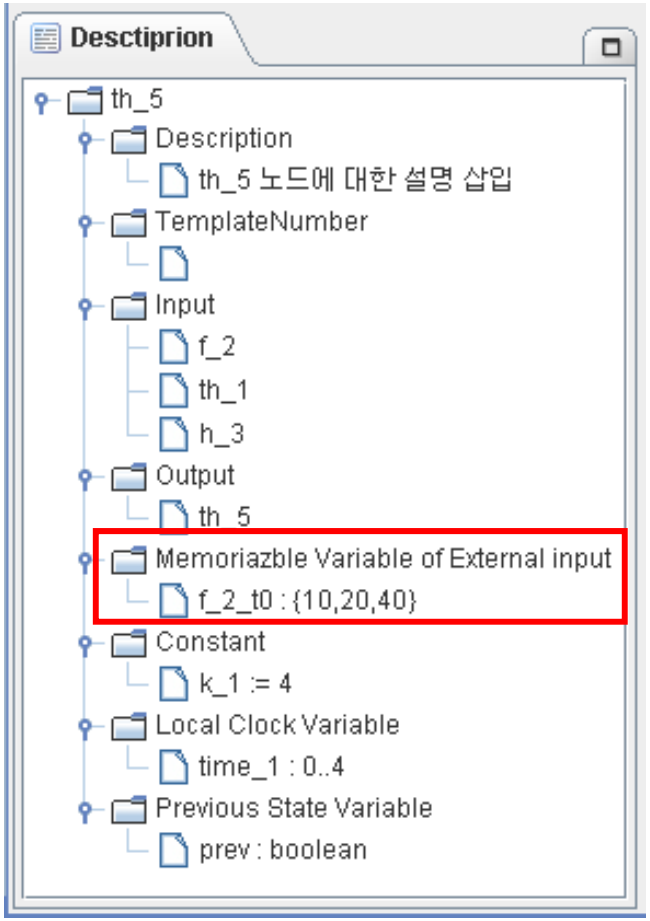
Description (5/9)



- Output
  - Shows all the output variables of the current active window.
  - Impossible to make direct changes from the description window.
  - When the output variable name in the parent FOD is changed, the same variable in the child FOD is automatically adjusted
  - f_, h_, and th_ nodes have only one output variable.
  - (Applies to all FOD, SDT, FSM, TTS)

KAIST

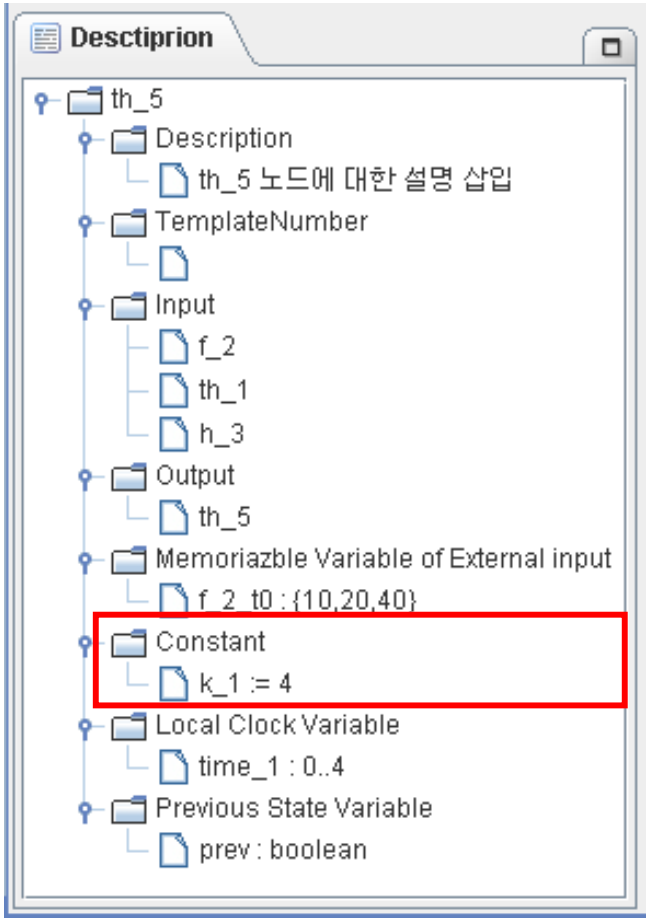
Description (6/9)



- Memorizable Variable of External input
  - Declare a variable that describes the previous scan value of an input variable
  - By adding a suffix such as _t0, _t1 to the input variable name, define which scan value it is.
    - t0 is one scan before, t1 is two scans before etc.
  - When “Memorizable variable of External input” is selected, Add, Delete and Edit can be performed by clicking the right mouse button.
  - (Applies only to FSM,TTS)

KAIST

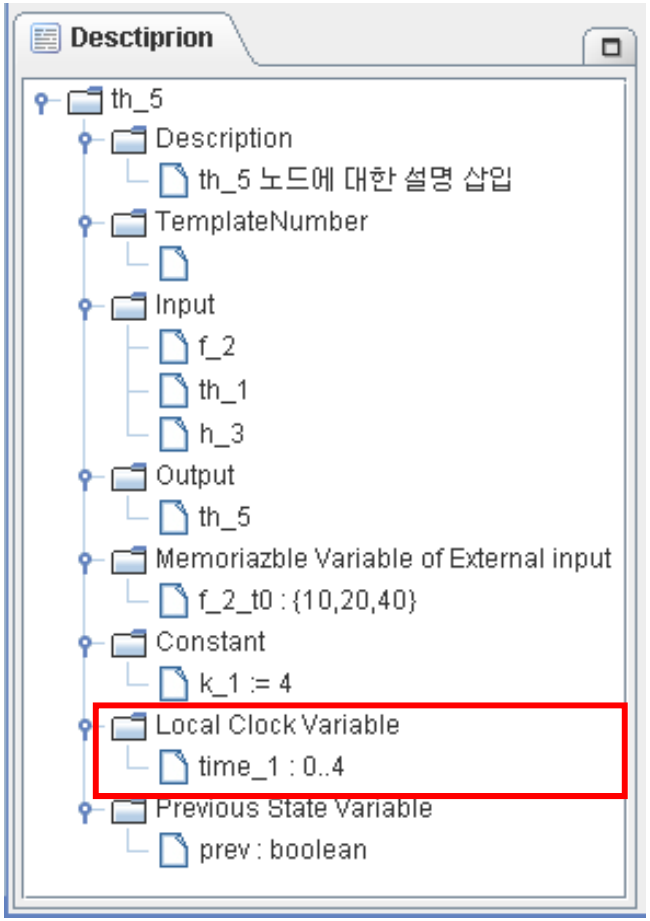
Description (7/9)



- Constant
  - Declare a constant value to be used in the corresponding diagram
  - When the “Constant” is selected, Add, Delete and Edit can be performed by clicking the right mouse button.
  - (Applies to all FOD, SDT, FSM, TTS)

KAIST

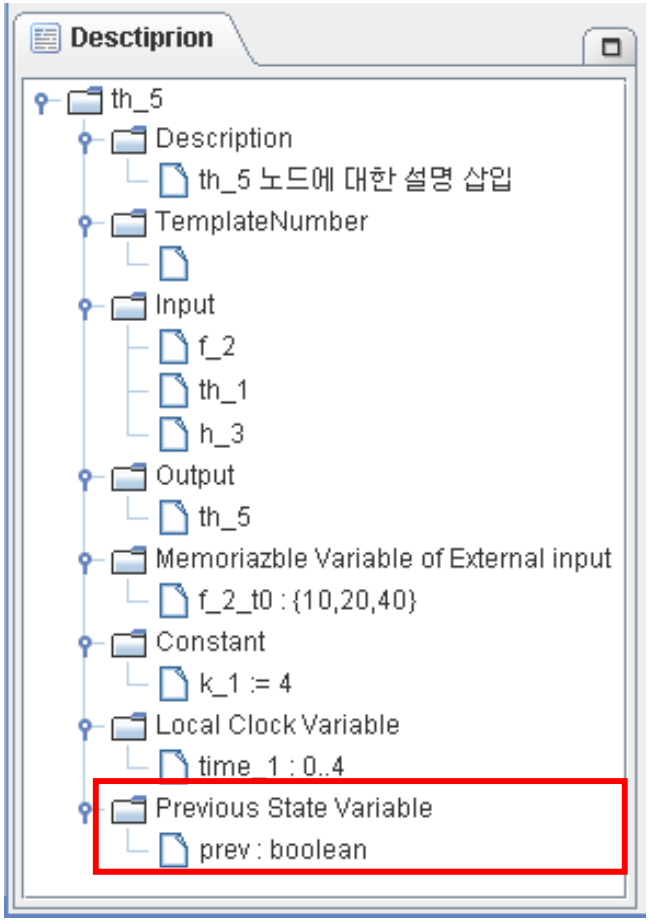
Description (8/9)



- Local Clock Variable
  - When TTS requires a time related transition label, a clock variable must be declared.
  - When the “Local Clock Variable” is selected, Add, Delete and Edit can be performed by clicking the right mouse button.
  - (Applies only to TTS)

KAIST

Description (9/9)



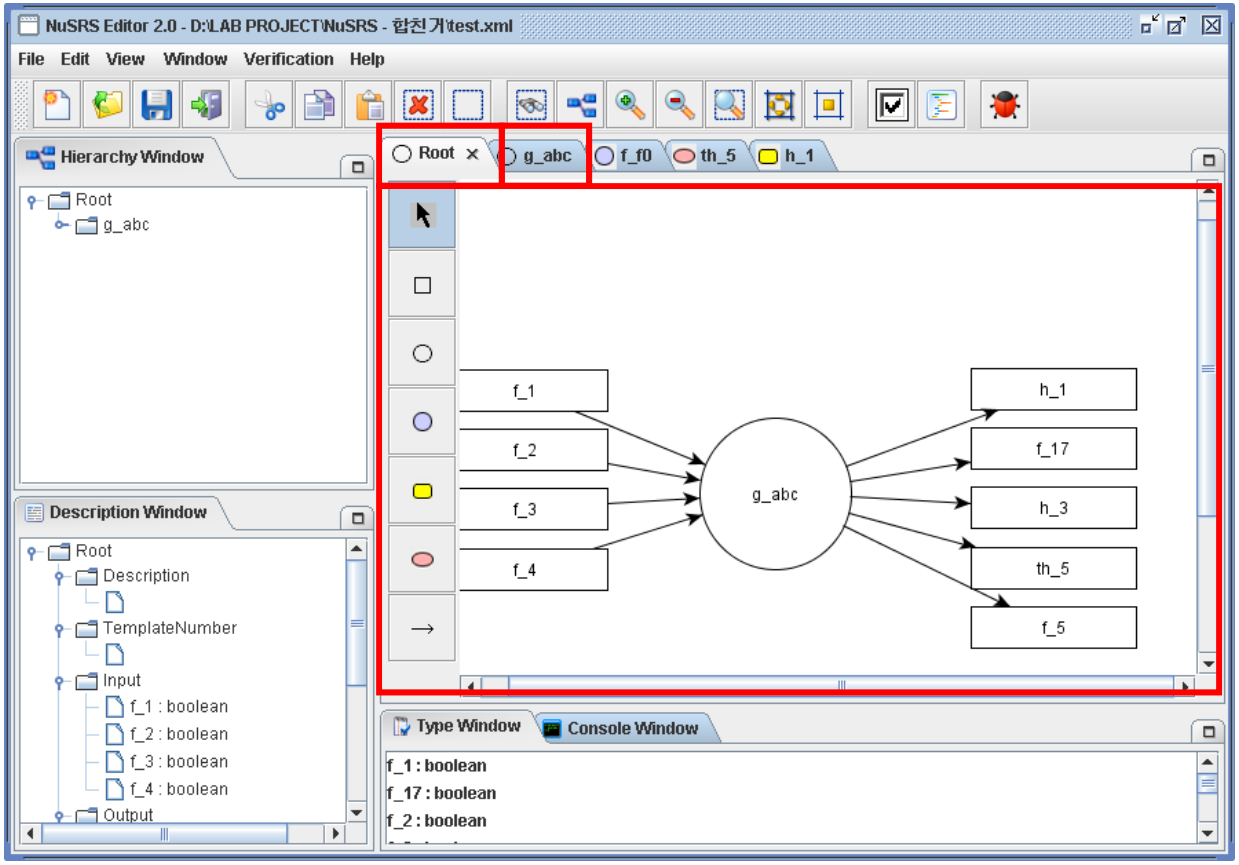
- Previous State Variable
  - Declare a variable that describes the previous scan value of an output variable
  - By adding a suffix such as _t0, _t1 to the output variable name, define which scan value it is.
    - t0 is one scan before, t1 is two scans before etc.
  - When the “Previous State Variable” is selected, Add, Delete and Edit can be performed by clicking the right mouse button.
  - (Applies only to FSM,TTS)

KAIST

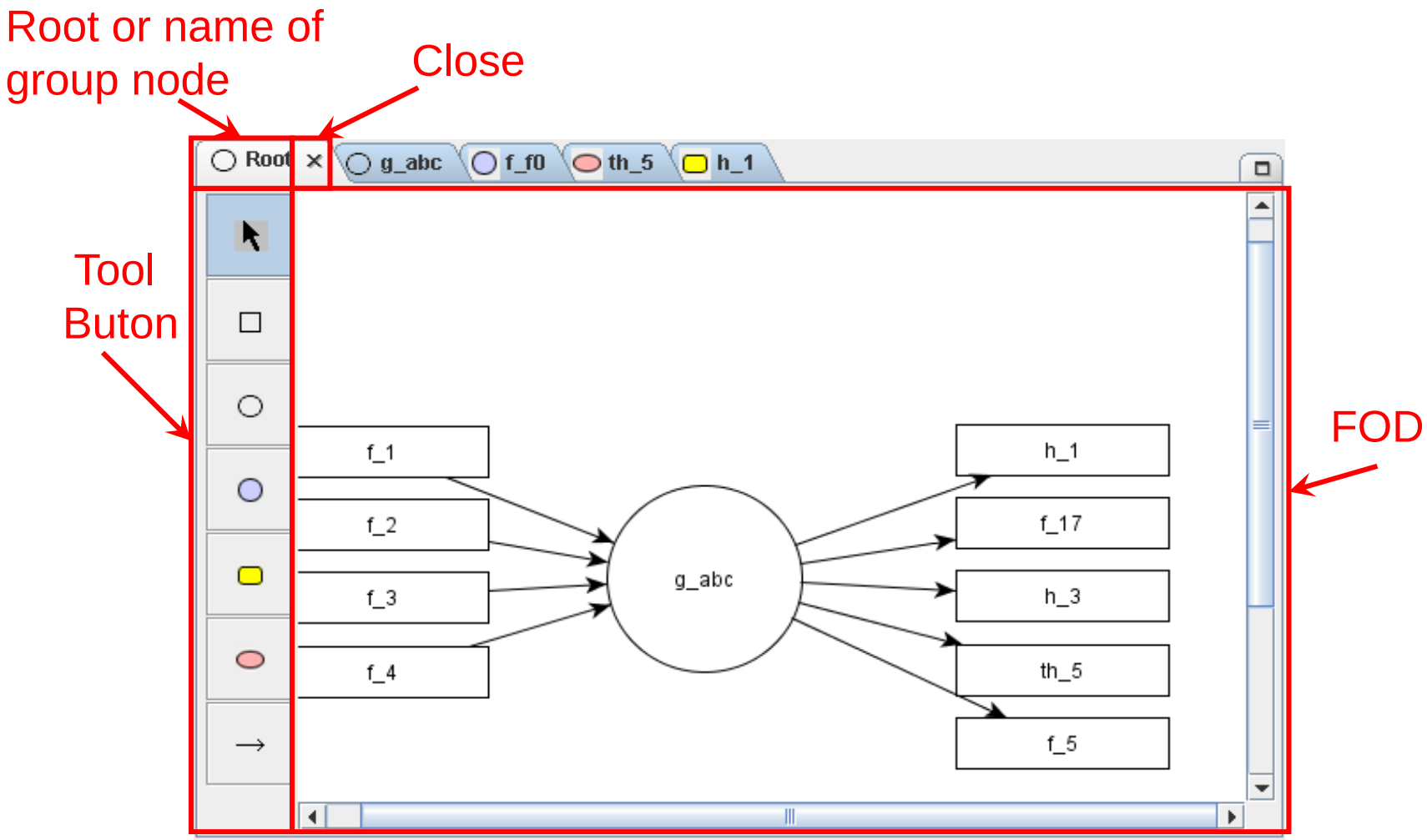
FOD,FSM(TTS),SDT
Edit Window

FOD Edit Window – Full Screen

- When a group node starting with g_ is double clicked
- Window that can edit the FOD



FOD Edit Window – Details



FOD Edit Window – Button (1/9)

Select

- Used to select each node and transition
- After clicking the selection button, click the node and transition in the edit window with the left mouse button
- Drag & drop is available for multiple selections.

KAIST

FOD Edit Window – Button (2/9)

IO node

- Used to edit input output nodes.
- IO node can only be connected to one outgoing transition or incoming transition.
- IO node can only be created in the top most FOD; once created in the top most FOD it is automatically created in the lower FOD.
- When an IO node is deleted from a lower FOD, the transition from the top most FOD is deleted, but the IO node itself is not deleted.

KAIST

FOD Edit Window – Button (3/9)

IO node (cont.)

1. Click the IO node button and click the left mouse button on the editing window.
2. When a dialog box for entering the node's name is shown, enter a node name and click ok.
3. As soon as the node's name is entered the node is edited.

FOD Edit Window – Button (4/9)

Group node

- Used to edit group nodes starting with g_.
- If the name does not begin with a g_, an error message is given and the name is re-entered.

1. Click the group node button and click the left mouse button on the edit window.
2. When a dialog box for entering the node's name is shown, enter a node name and click ok.
3. As soon as the node's name is entered the node is edited.

KAIST

FOD Edit Window – Button (5/9)

Function node

- Used to edit function nodes starting with f_.
- If the name does not begin with a f_, an error message is given and the name is re-entered.

1. Click the function node button and click the left mouse button on the edit window.
2. When a dialog box for entering the node's name is shown, enter a node name and click ok.
3. When a dialog box for entering the node's name is shown, enter a node name and click ok.

KAIST

FOD Edit Window – Button (6/9)

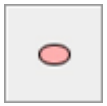
History node

- Used to edit history nodes starting with h_.
- If the name does not begin with a h_, an error message is given and the name is re-entered.

1. Click the history node button and click the left mouse button on the edit window.
2. When a dialog box for entering the node's name is shown, enter a node name and click ok.
3. When a dialog box for entering the node's name is shown, enter a node name and click ok.

KAIST

FOD Edit Window – Button (7/9)



Timed History node

- Used to edit timed history nodes starting with th_.
- If the name does not begin with a th_, an error message is given and the name is re-entered.

1. Click the timed history node button and click the left mouse button on the edit window.
2. When a dialog box for entering the node's name is shown, enter a node name and click ok.
3. When a dialog box for entering the node's name is shown, enter a node name and click ok.

KAIST

FOD Edit Window – Button (8/9)

Transition

- Used to edit transitions between nodes.
- A Self-Transition in FOD is not allowed.
- After clicking the Transition button once, multiple transitions can be drawn until another button is clicked.
- As soon as a transition from an IO node is drawn, we decide whether it is an input or output node, and this information change automatically in the description window.

FOD Edit Window – Button (9/9)

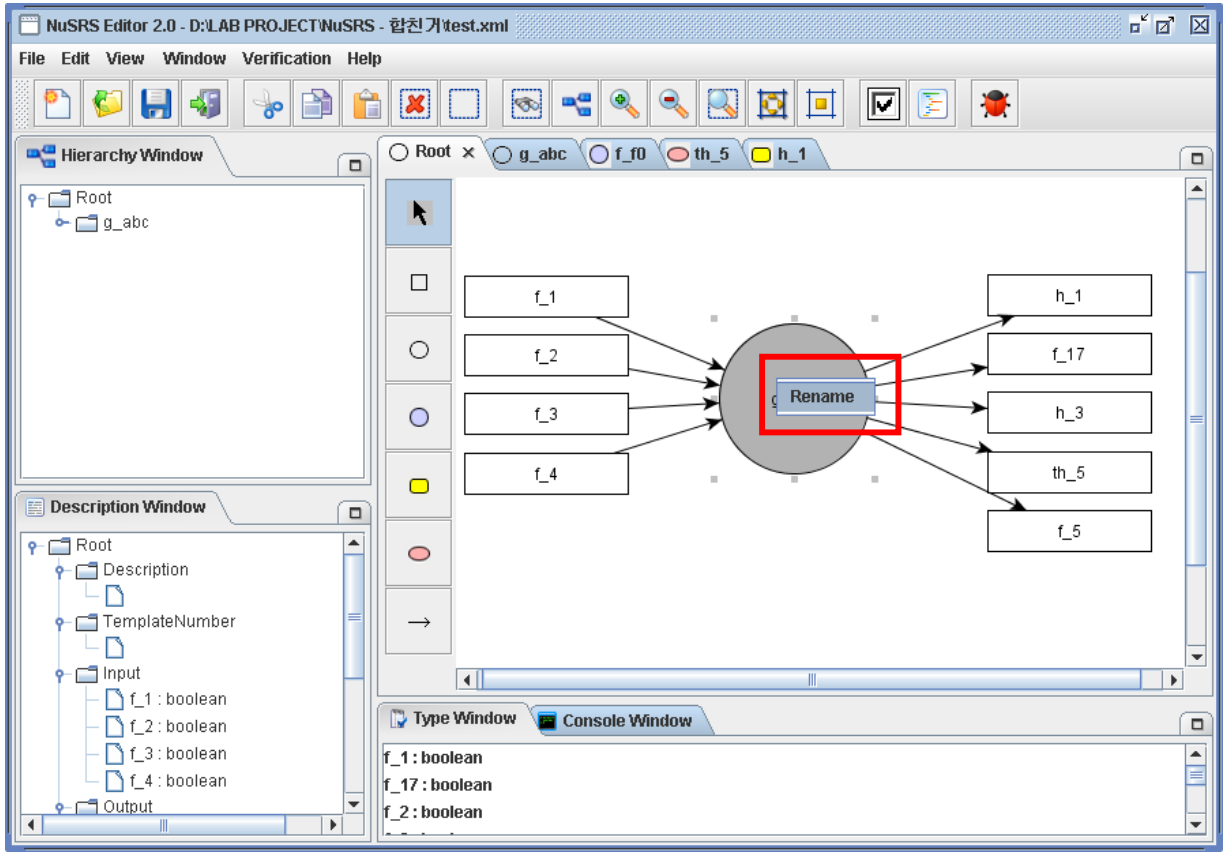
Transition (cont.)

1. Click the Transition button.
2. Click and drag the Source node, and drop it at the Destination node.
   - When making a transition between group nodes, must input a transition name.
     - A transition name must be one of the output nodes' names from the source group node.
     - When a group node → group node transition is drawn, a input node with the same name is automatically created in the target group node.
     - When a transition name is not one of the output node's names in the source group node, then an output node with the corresponding name is automatically created.

KAIST

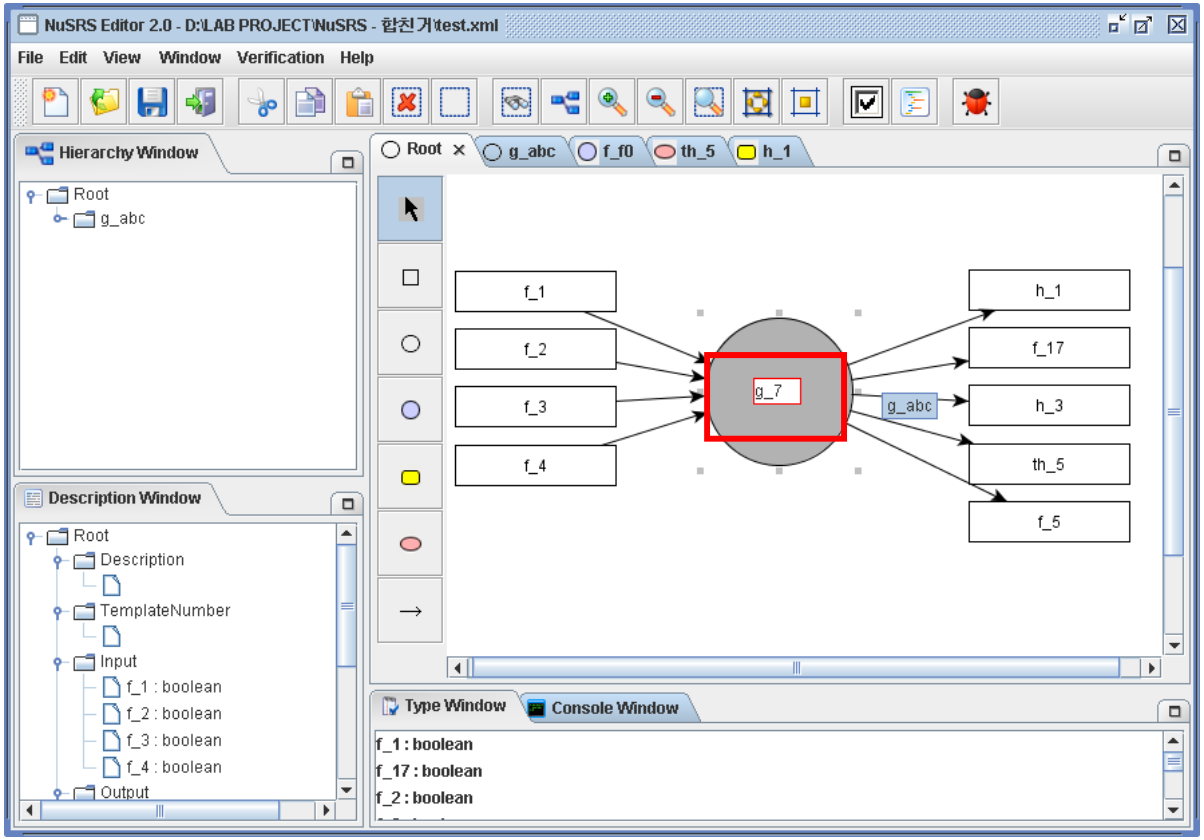
FOD Edit Window – Rename Node

1. Select the node, right click and select Rename.



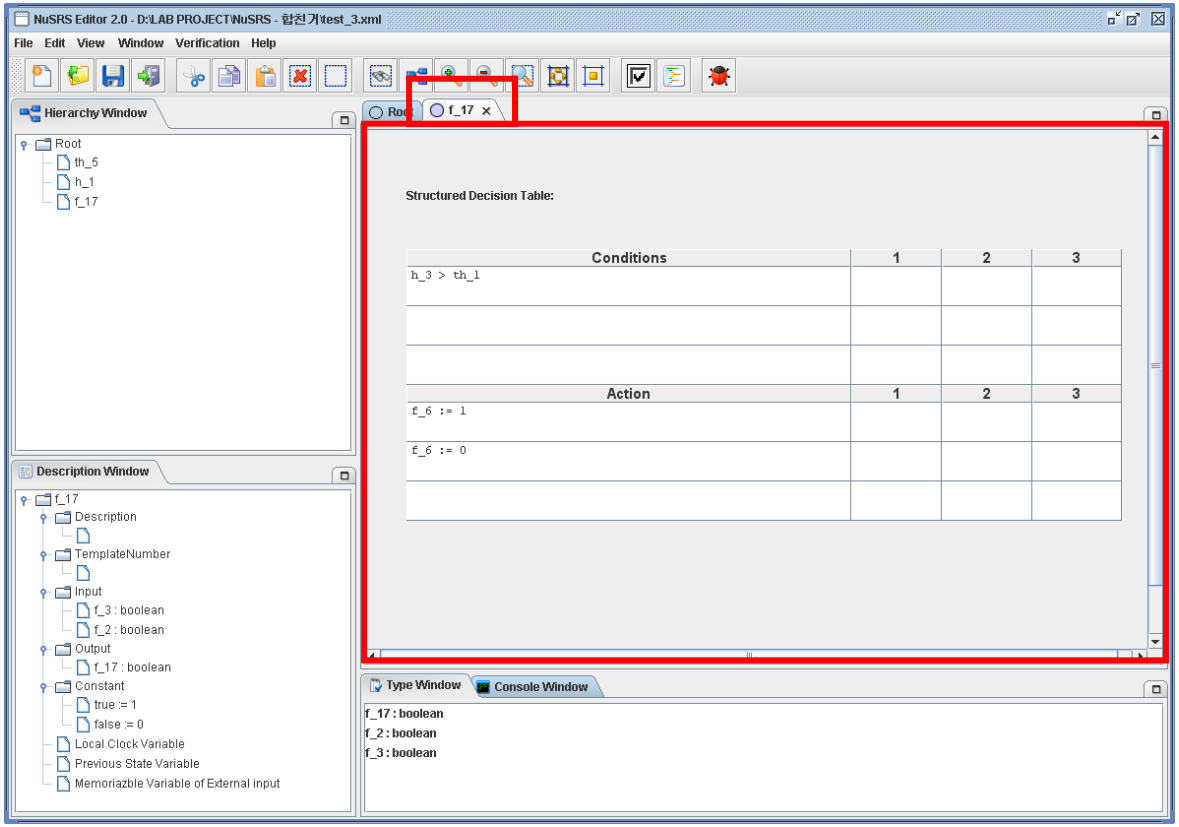
FOD Edit Window – Rename Node

2. Change the name when the node name becomes a changeable state, then click the left mouse button and the renaming is done.

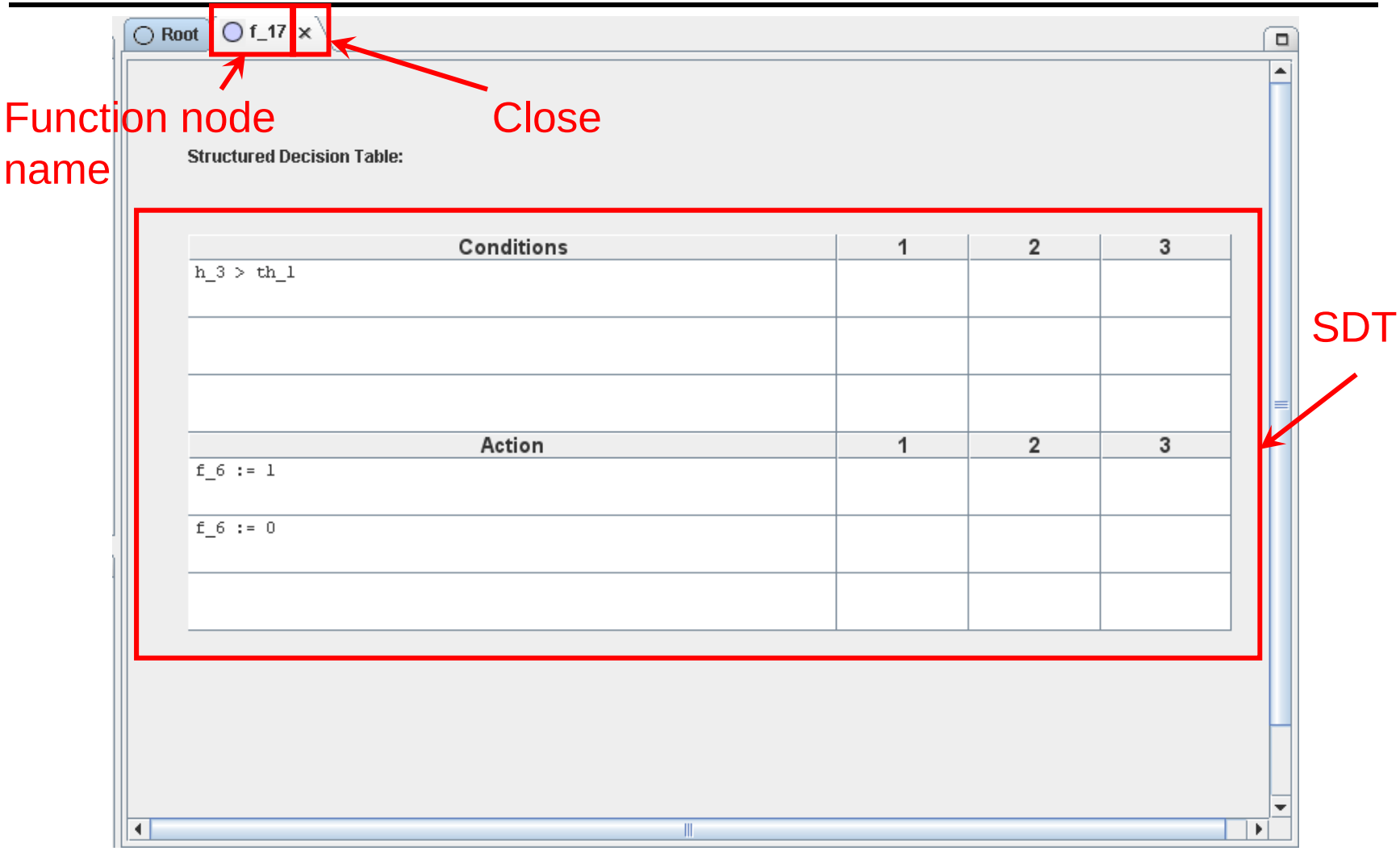


SDT Edit Window – Full Screen

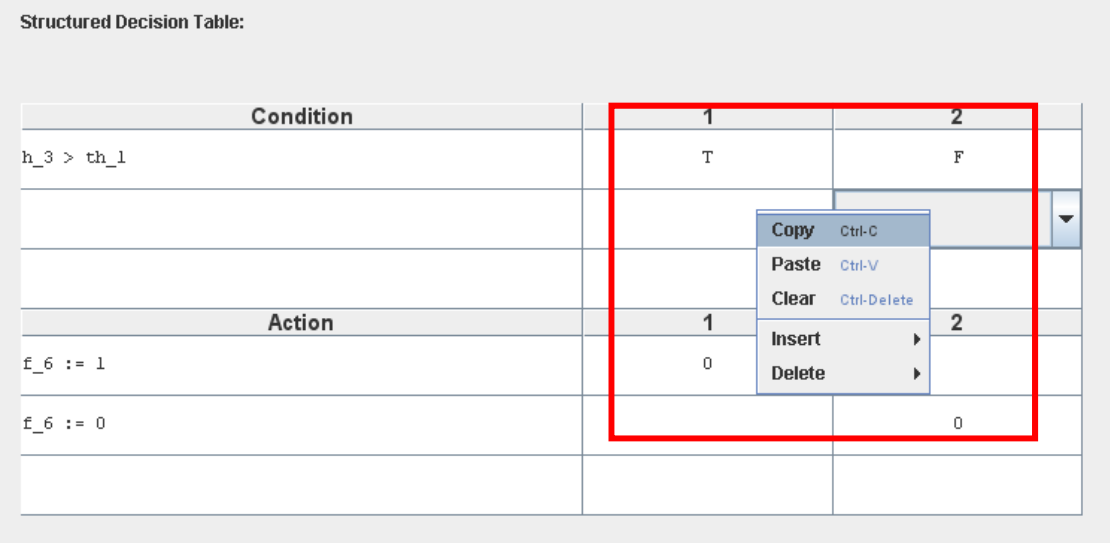
- When double clicked a node starting with f_
- A table-like window that can edit SDT



SDT Edit Window – Details (1/2)



SDT Edit Window – Details (2/2)

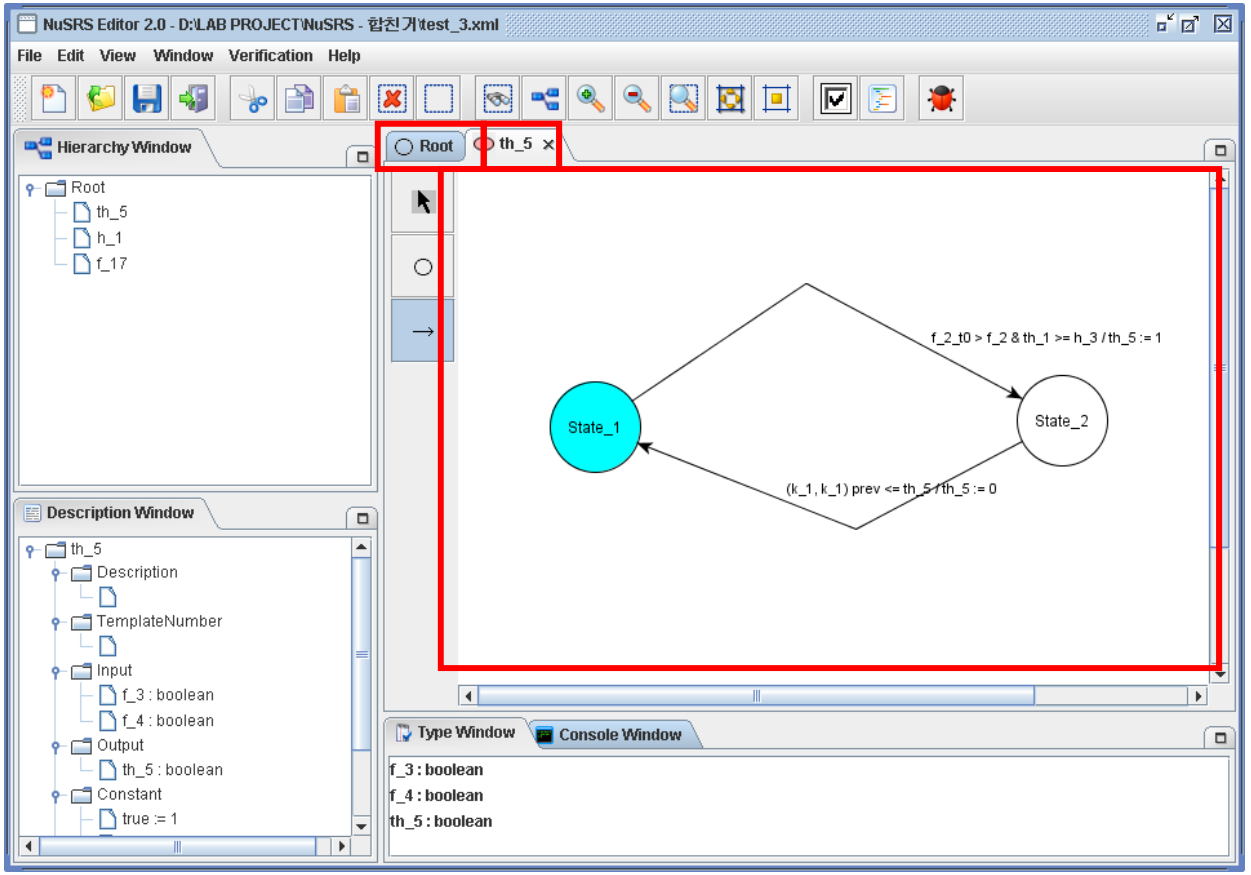


- Structured Decision Table
  - A table based on NuSCR semantics.
  - By clicking the right mouse button at each row/column, a row/column can be added, copied, pasted, deleted etc.

KAIST

FSM, TTS Edit Window – Full Screen

- When a node starting with h_ or th_ is double clicked
- A window that can edit FSM and TTS

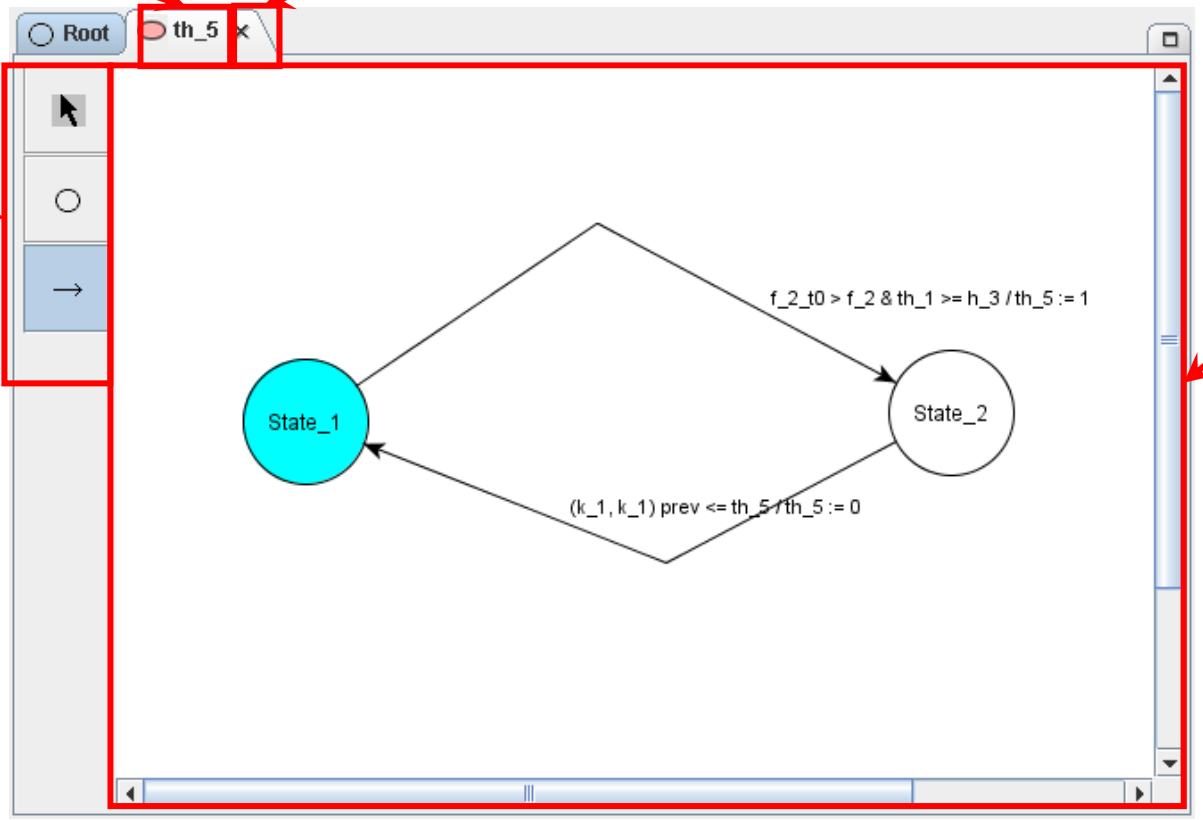


FSM, TTS Edit Window – Details

History node or
Timed history node
name

Close

Tool
button



FSM or
TTS

FSM, TTS Edit Window – Button (1/3)

Select

- Used to select the State and transition.
- After clicking the Selection button, click the left mouse button on the state and transition to be edited in the edit window.
- Drag & drop is possible for Multiple Selection.

FSM, TTS Edit Window – Button (2/3)

State

- Used to draw States.
- A State name must not include blank spaces or symbols.

1. Click the State button and click the left mouse button on the edit window.
2. When a dialog box for entering the State name pops up, enter the State name and click ok.
   - If the State name is entered wrong, an error message is given and the name is re-entered.
3. As soon as the State name is inputted, the state is edited.

KAIST

FSM, TTS Edit Window – Button (3/3)

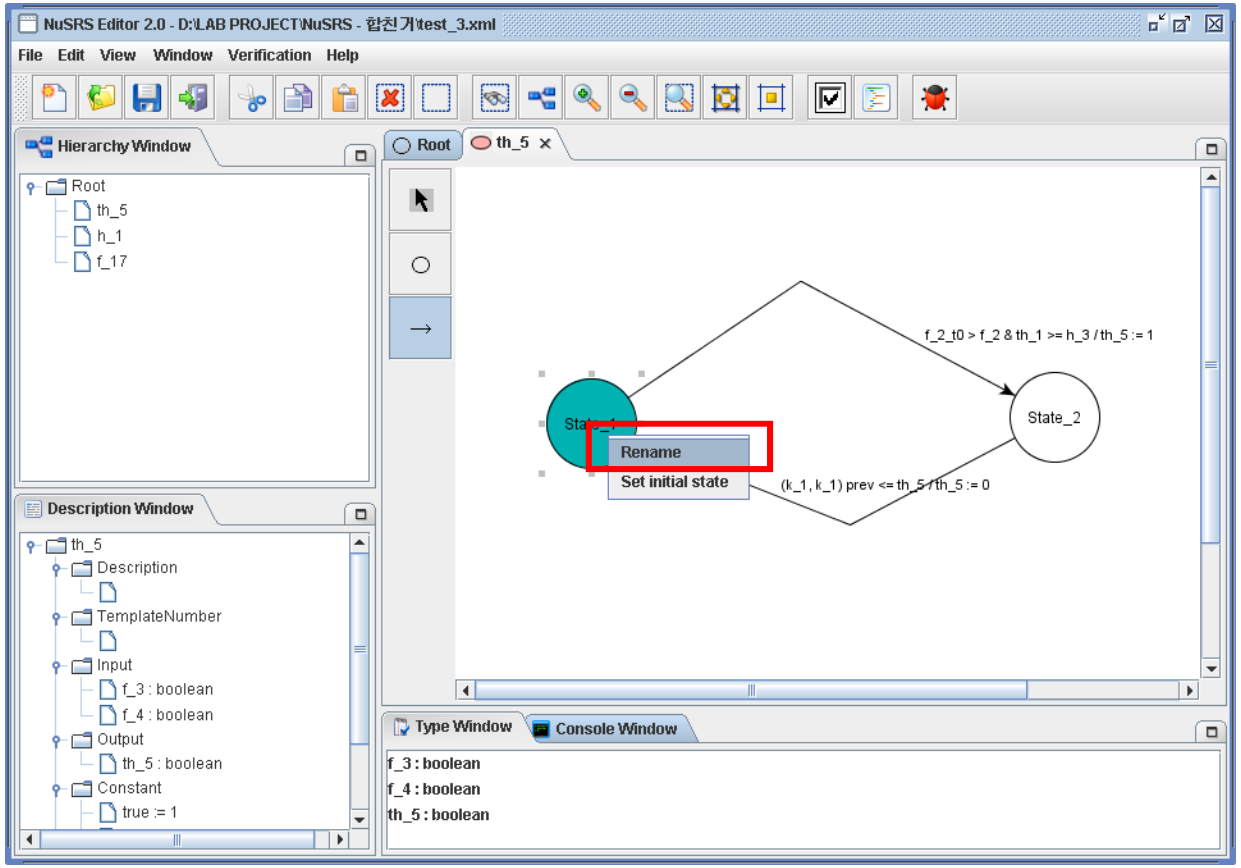
Transition

- Used to edit transitions between States.
- In FSM and TTS, at most one self-Transition can be drawn.
- Once clicking the Transition button once, many transitions can be drawn until another button is pressed.

1. Click the Transition button.
2. Click the Source state and drag, drop at the Target state.

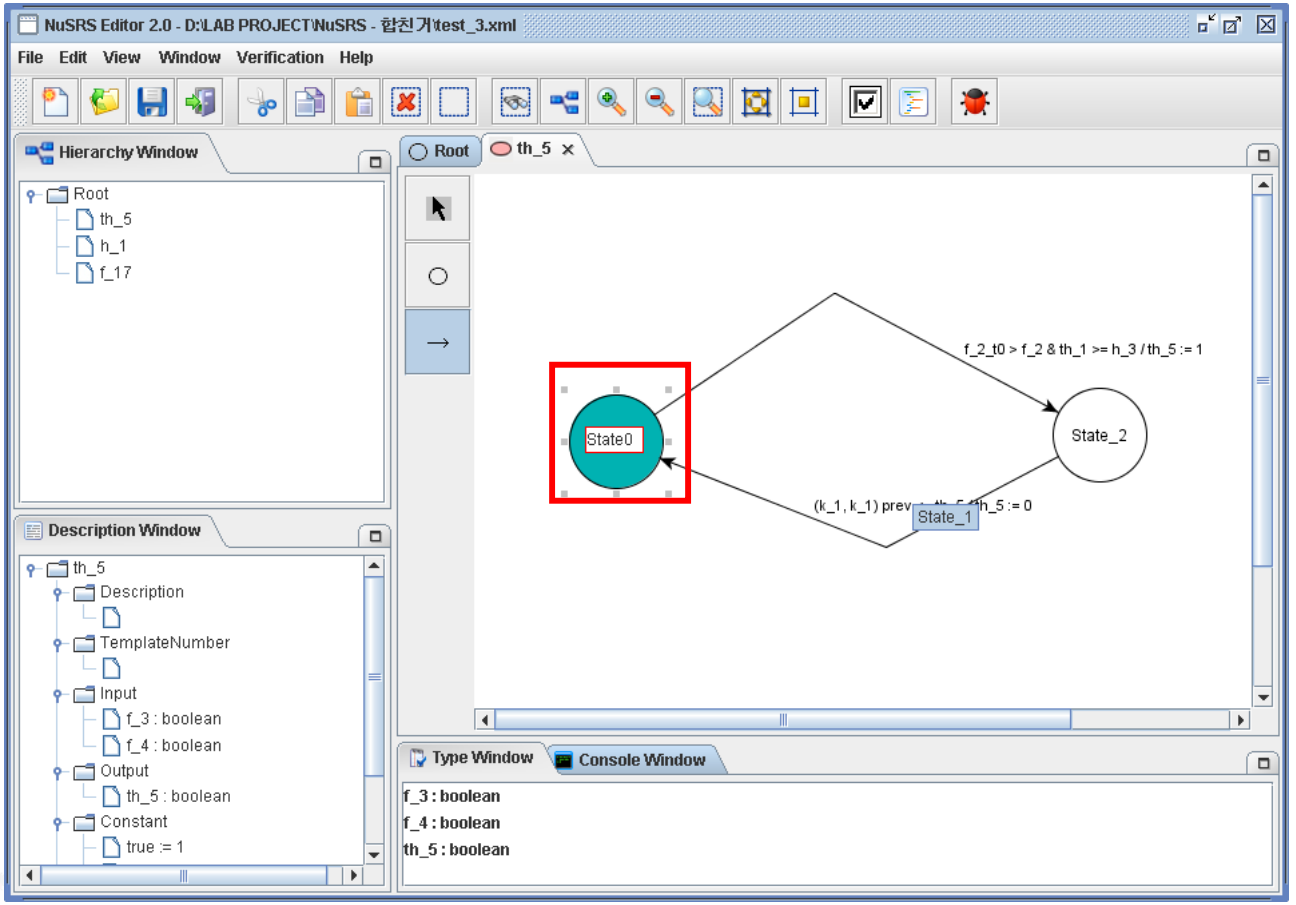
FSM, TTS Edit Window – Rename State (1/2)

1. Click the state, right click and select Rename.



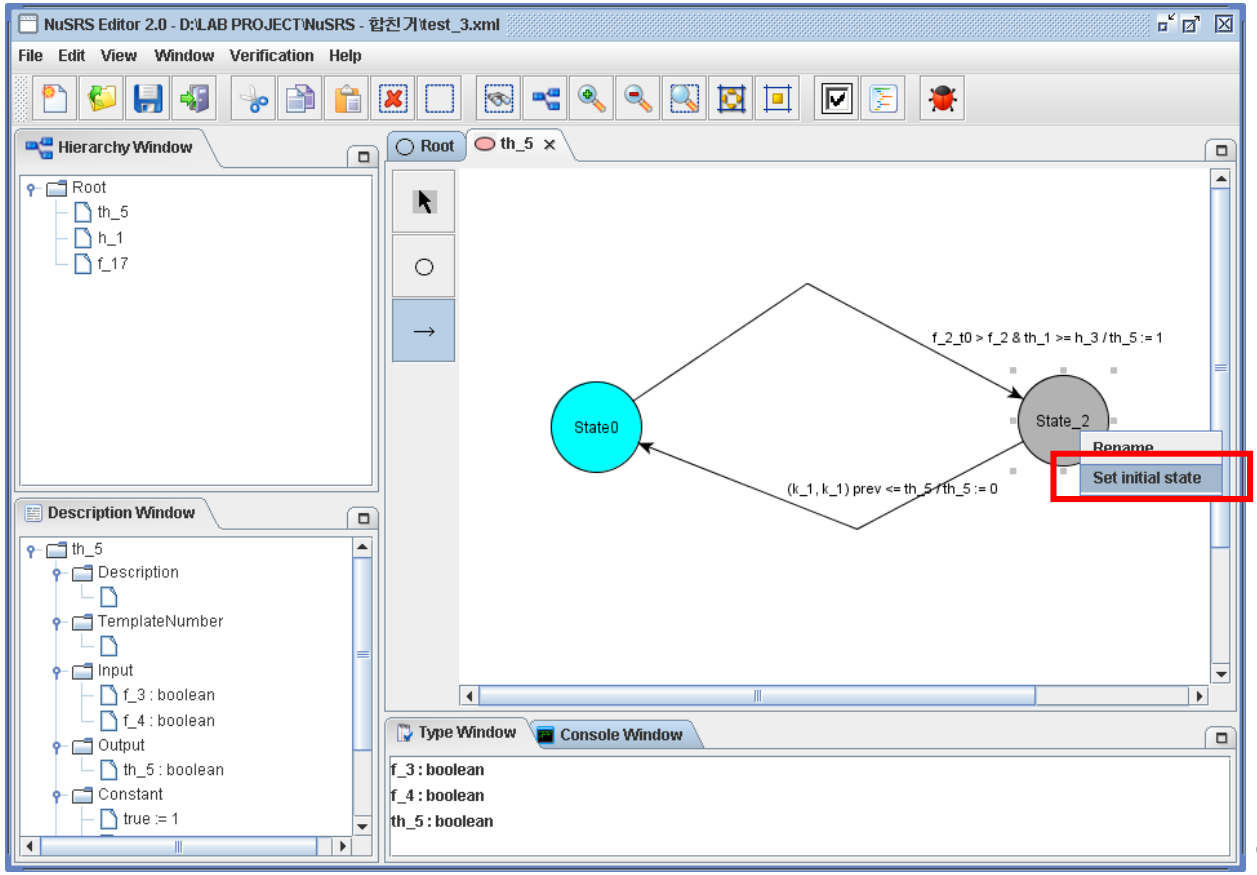
FSM, TTS Edit Window – Rename State (2/2)

2. Change the name when the node name becomes a changeable state, then click the left mouse button and the renaming is done.



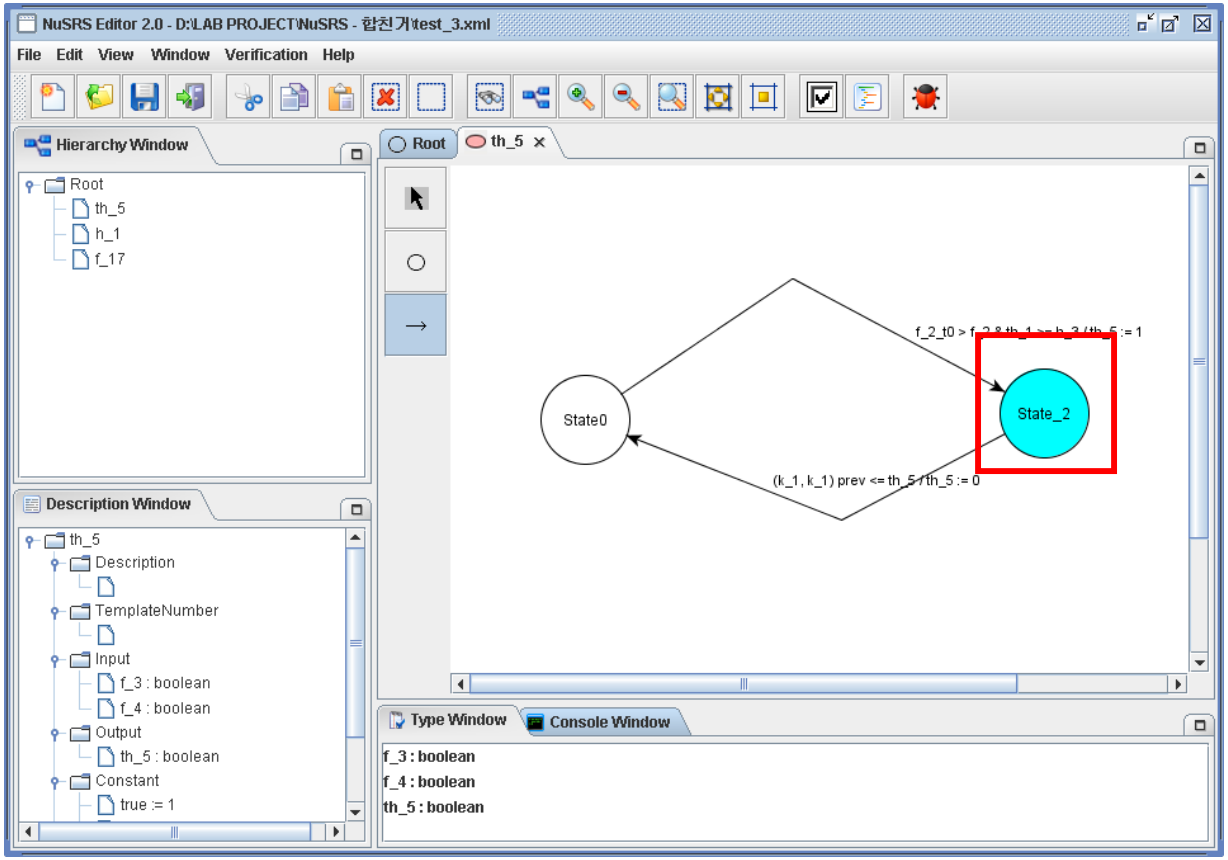
FSM, TTS Edit Window – Set Initial State (1/2)

1. Click the state, then right click and select set initial state.



FSM, TTS Edit Window – Set Initial State (2/2)

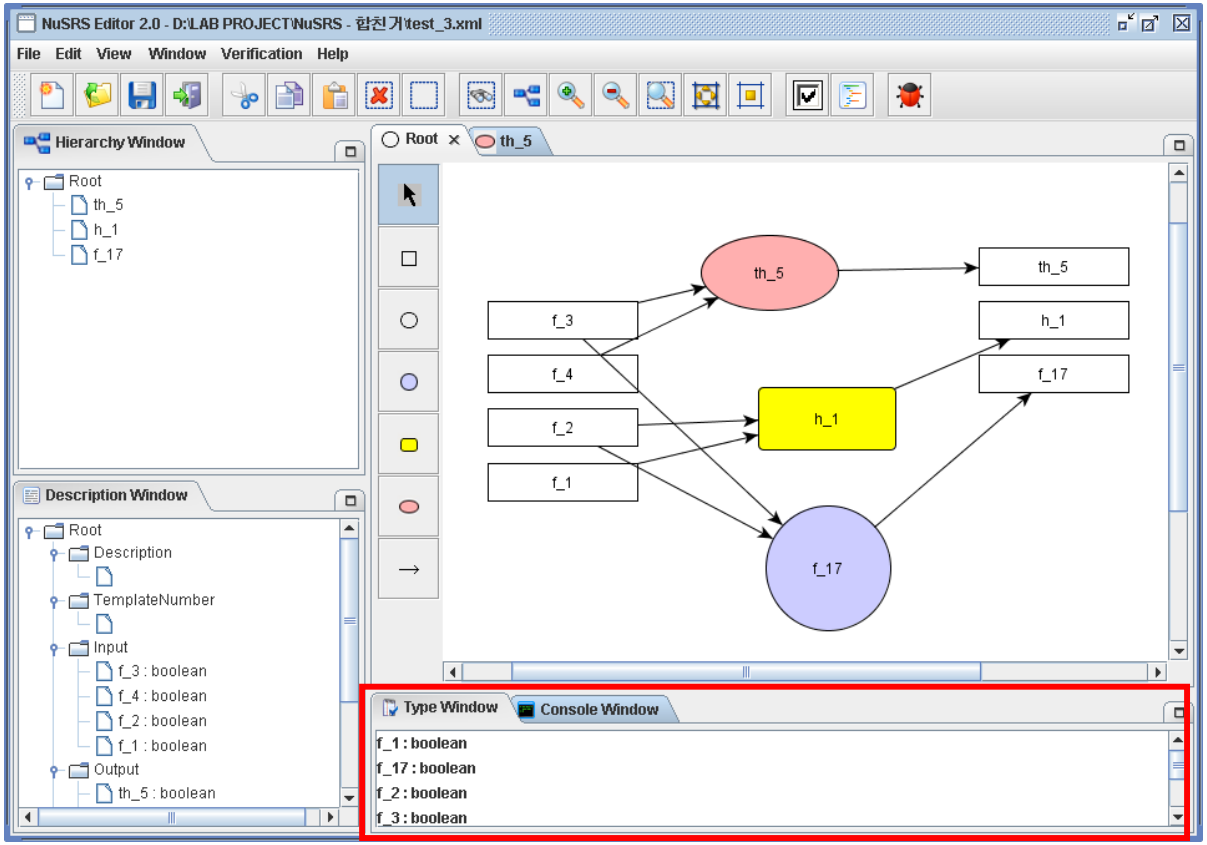
2. The selected state becomes an initial state, and the original initial state becomes a normal state.



Type Window

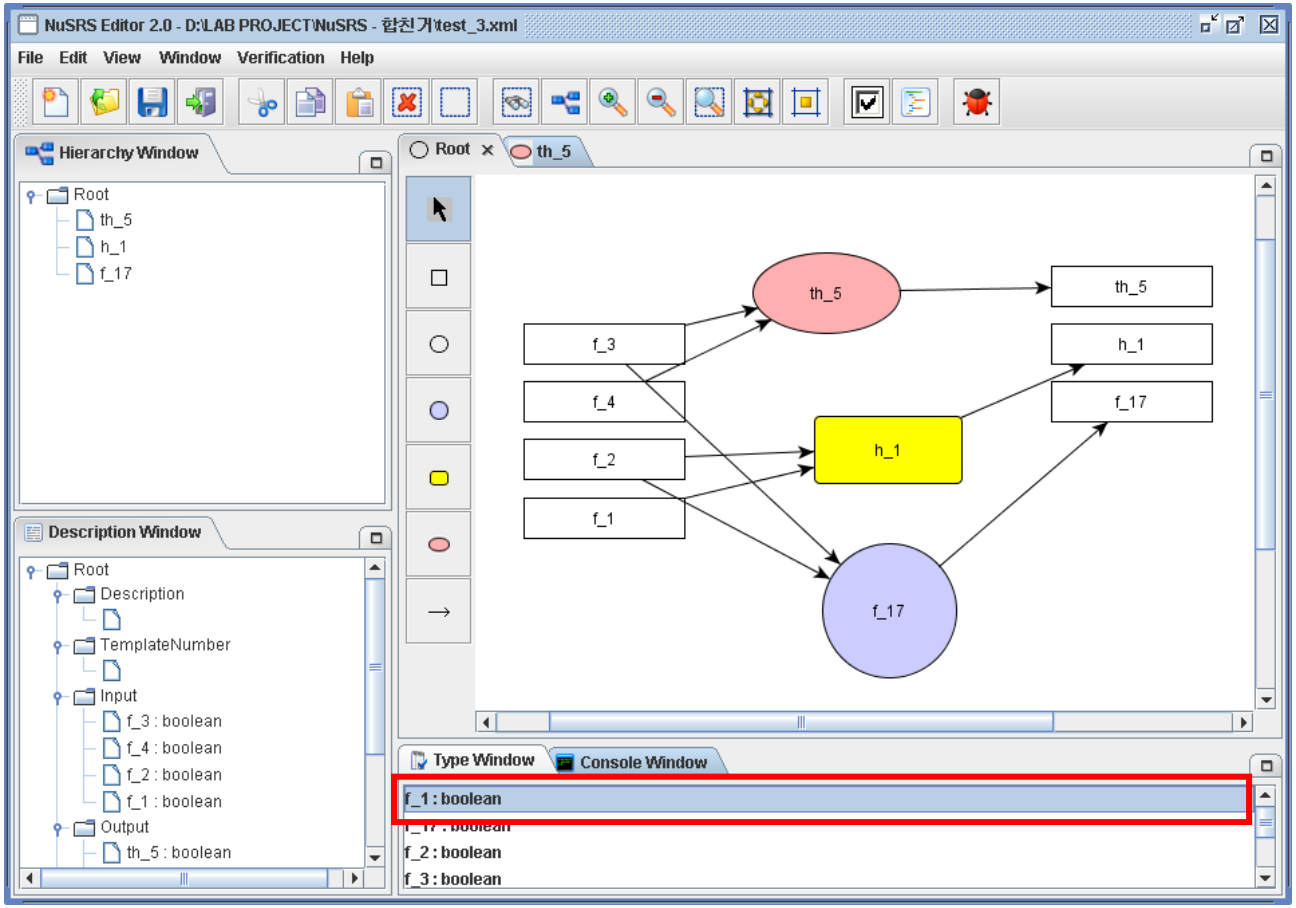
Type Window

- A window that records all variables used in the diagram, and allows editing of the variable types



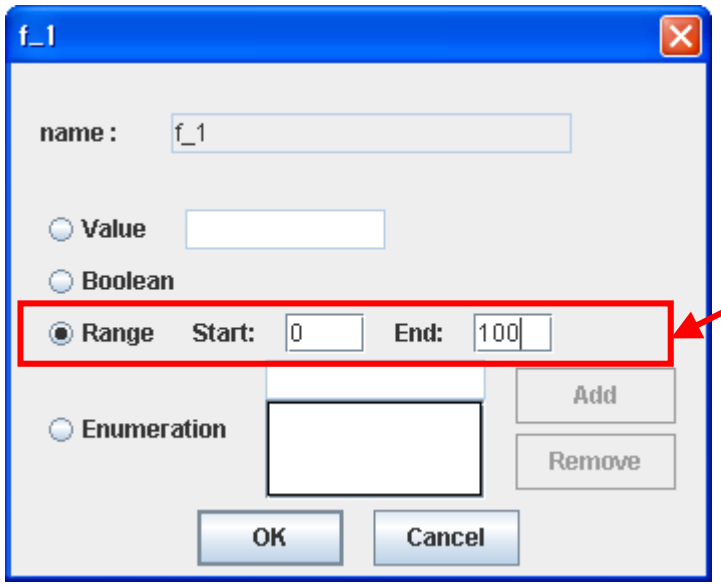
Edit Type Window (1/3)

1. Click the variable and double click.



Edit Type Window (2/3)

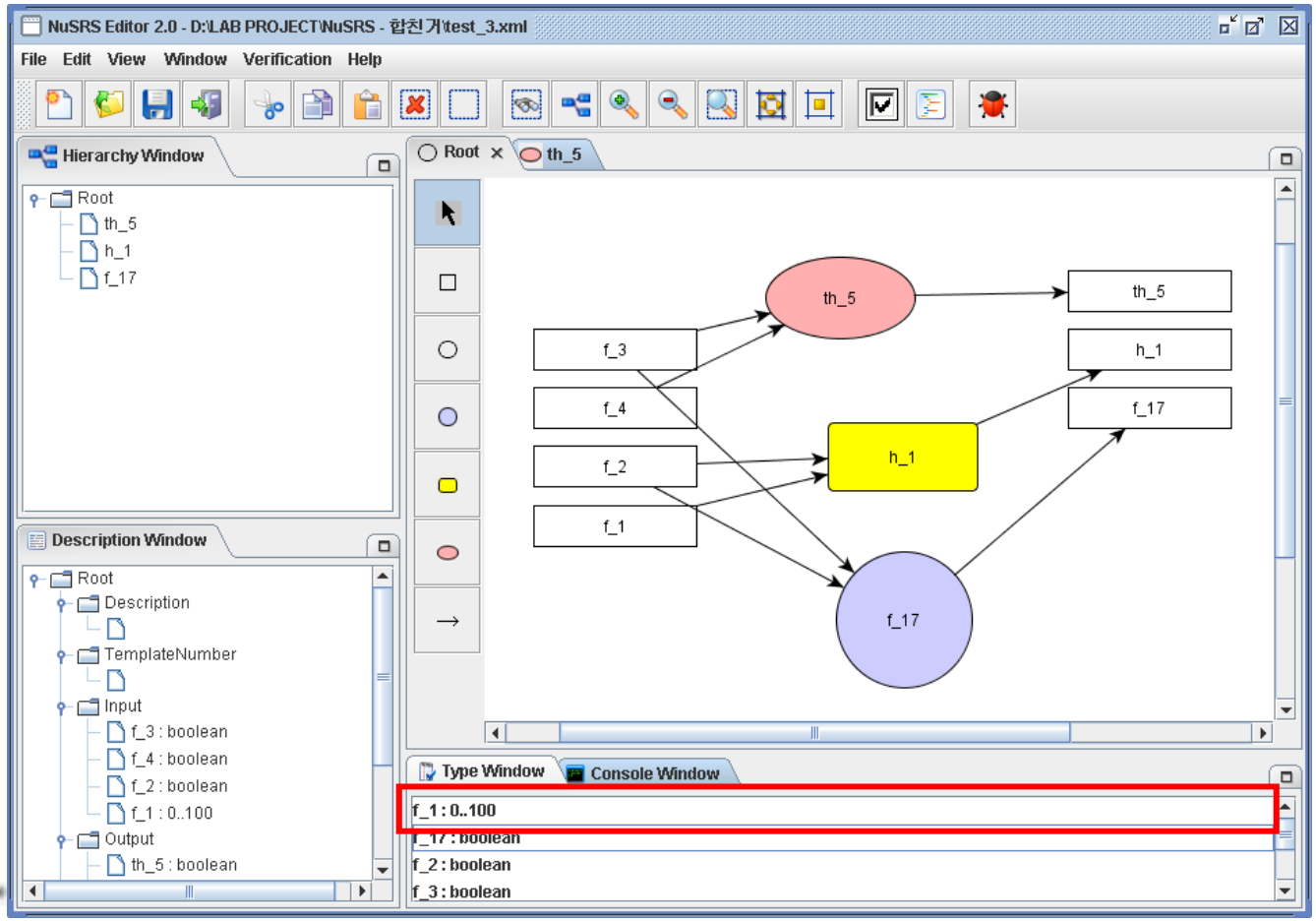
2. In the variable type dialog box select the type and click ok.



change the original setting of boolean into range type

Edit Type Window (3/3)

3. The variable's type has been changed.



Other supported item functions

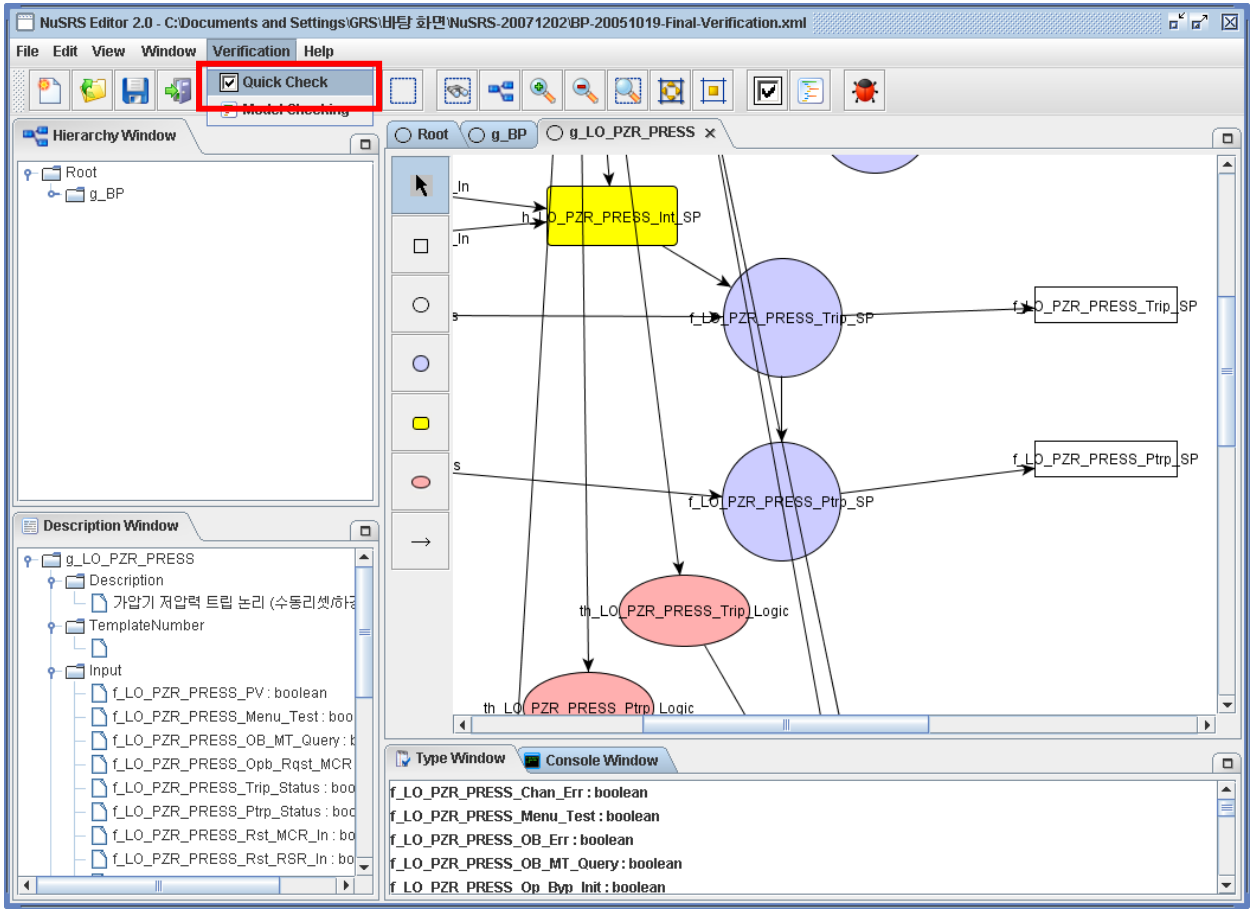
- Check whether variable names are repeated or not.

KAIST

Quick Check

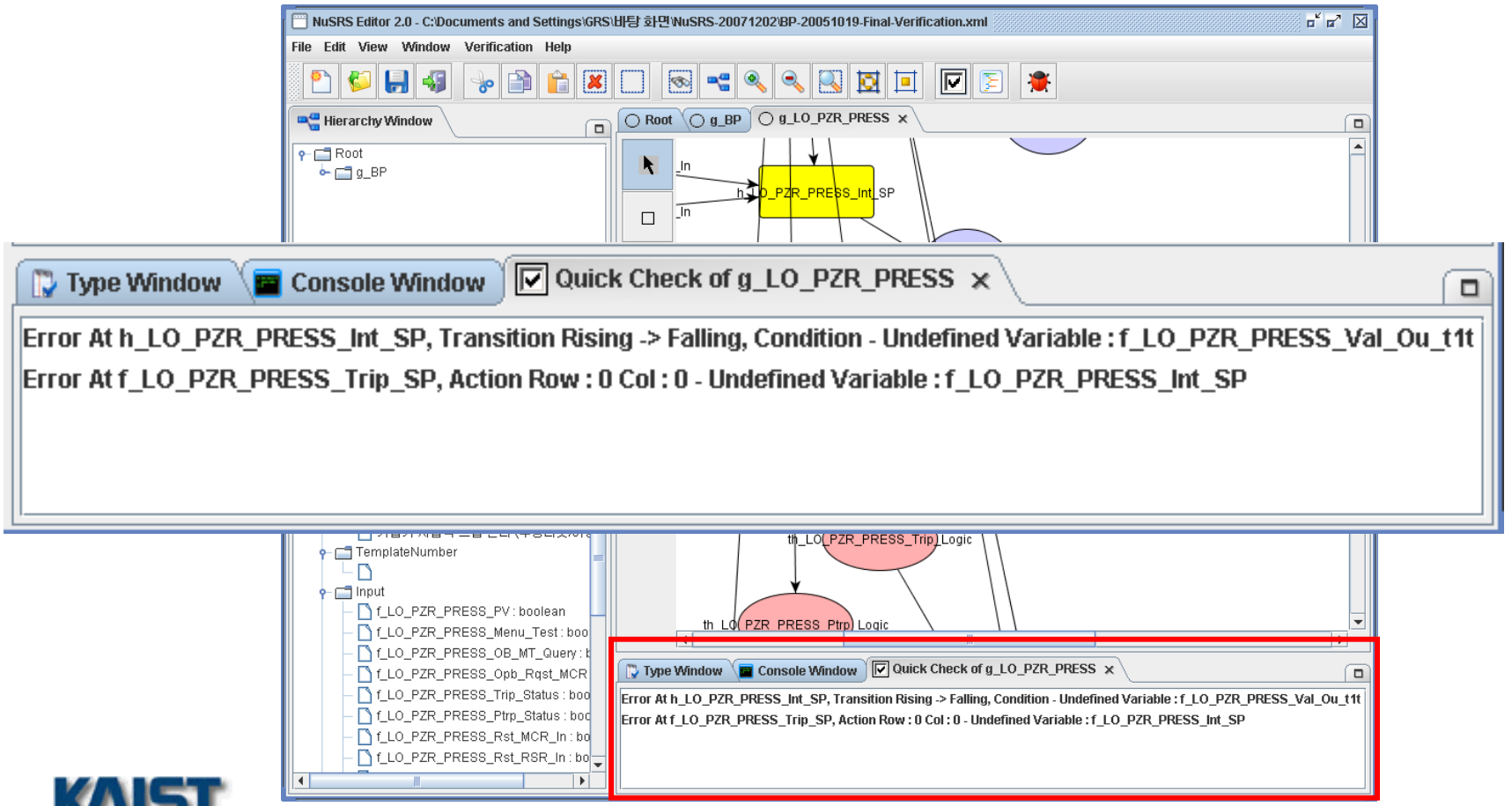
Verification > Quick Check (1/4)

1. Select Verification > Quick Check.



Verification > Quick Check (2/4)

2. See the Result on the right of the Type Window.



Verification > Quick Check (3/4)

- Quick Check checks diagram which is being edited and child nodes of the diagram.
- To check entire model, execute Quick Check when you are editing root node.

KAIST

Verification > Quick Check (4/4)

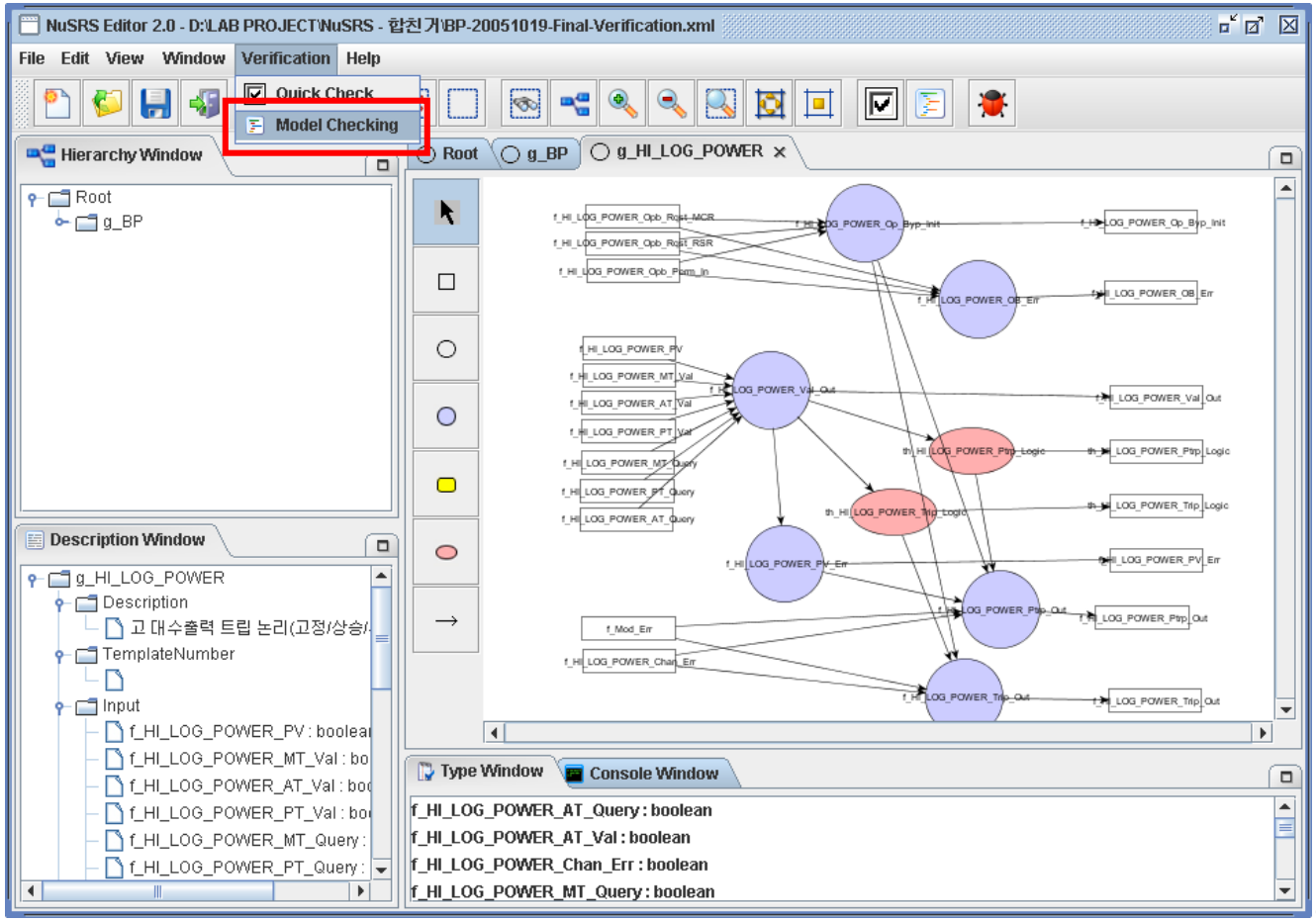
- Errors checked by Quick Check
  1. Undefined variables in SDT's Conditions and Actions
  2. Syntax errors in SDT conditions and actions
  3. More than one action allocated in SDT conditions
  4. Undefined variables in FSM and TTS transitions
  5. Syntax errors in FSM and TTS Transitions
  6. FOD, FSM and TTS nodes which have no transition
  7. Nodes unreachable from initial state in FSM and TTS
  8. Output variable and its connected node have different names

KAIST

Model Checking

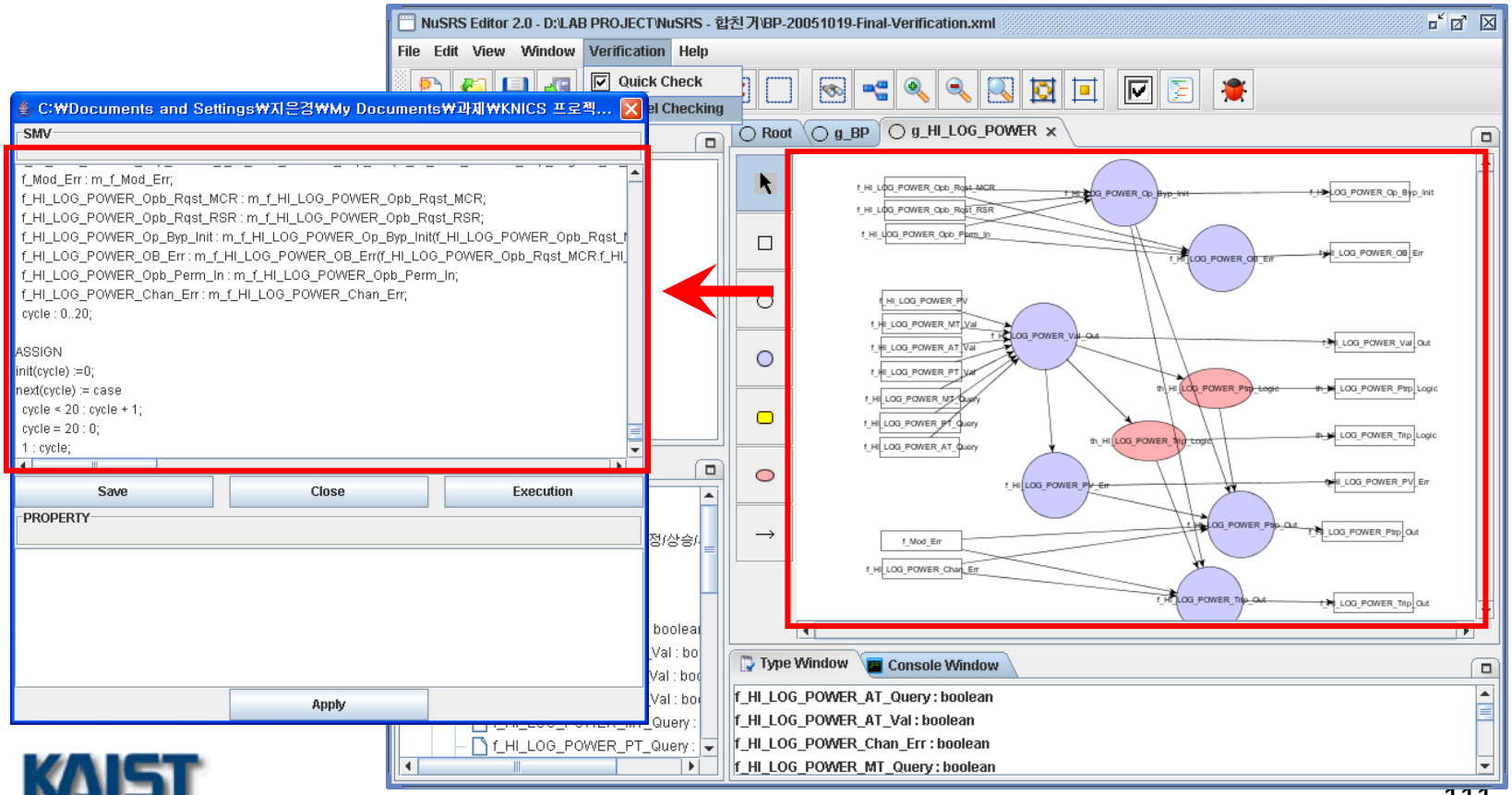
Verification > Model Checking (1/6)

1. Select Verification > Model Checking.



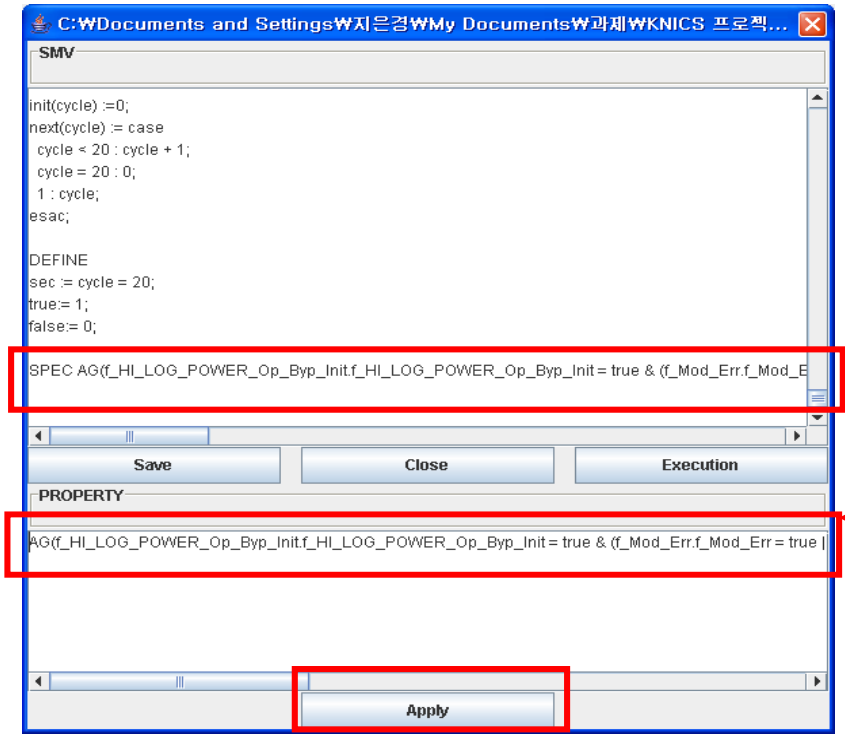
Verification > Model Checking (2/6)

2. A result window that converts the current window's NuSCR contents into SMV input language is given.



Verification > Model Checking (3/6)

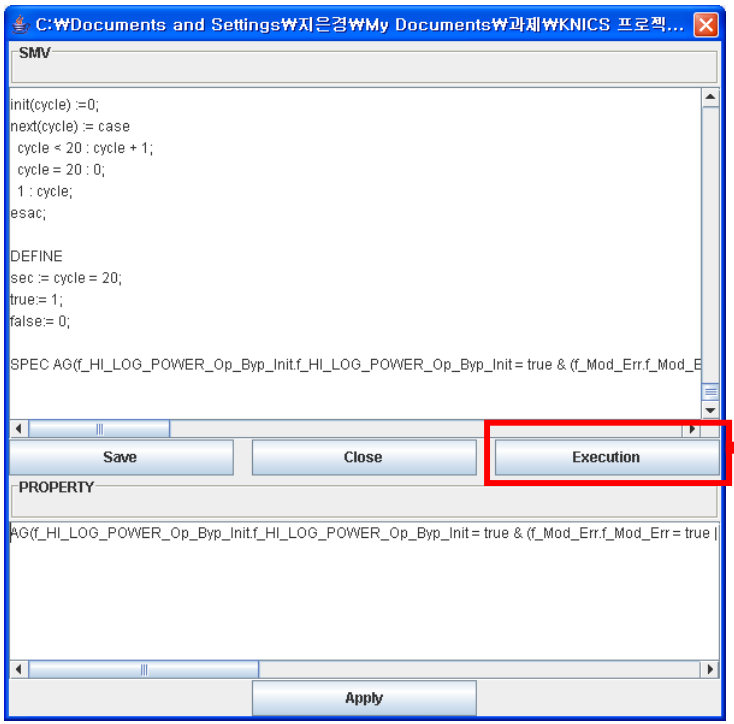
3. After entering the verification properties, click the Apply button and it is applied to the SMV input (SMV input window is editable)

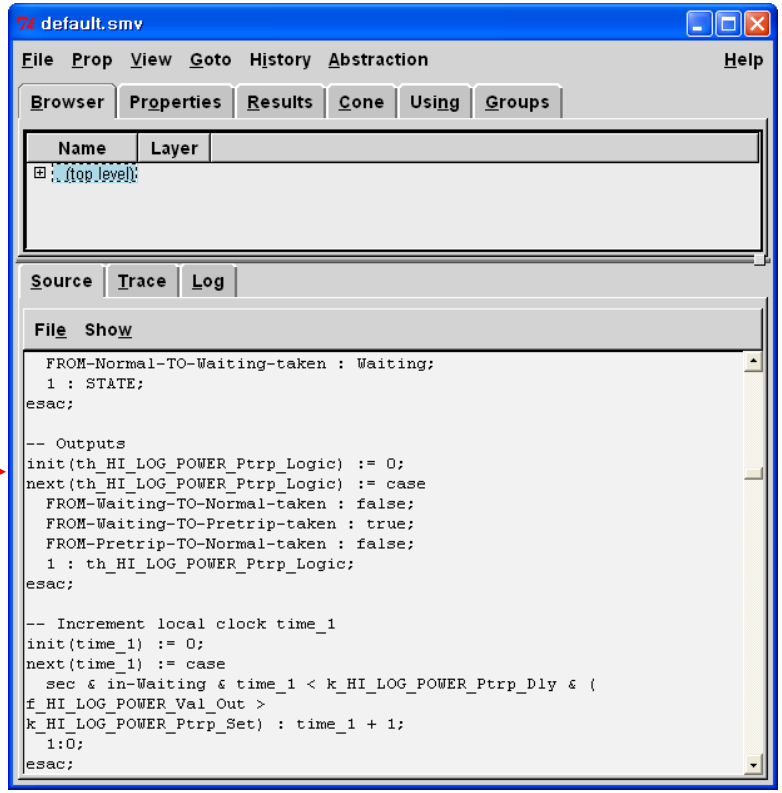


← Input verification properties (CTL)

Verification > Model Checking (4/6)

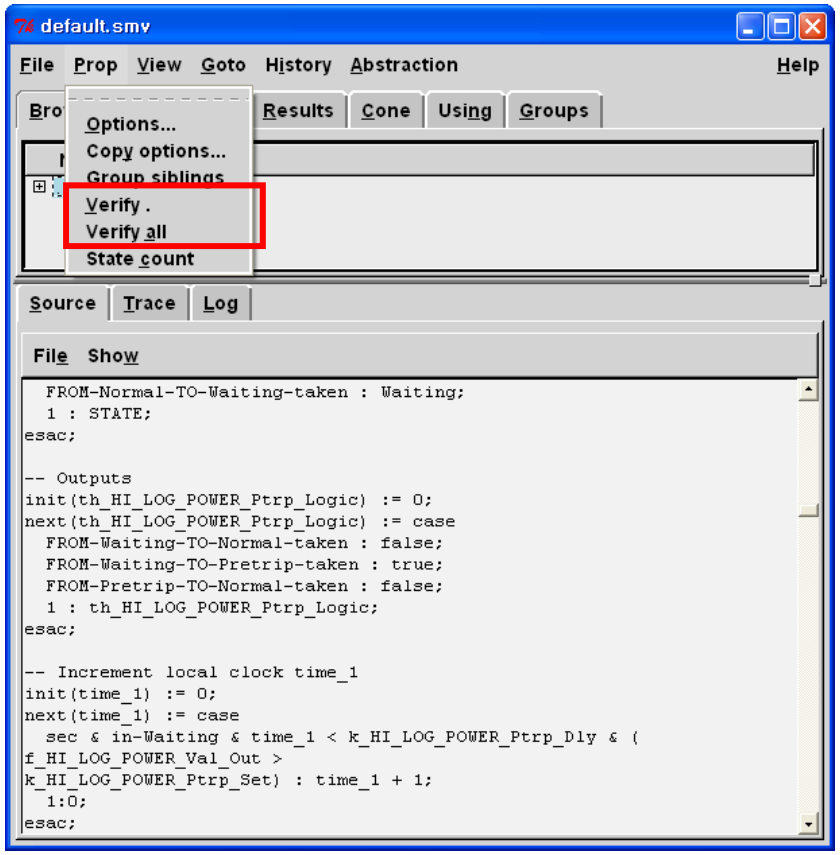
4. Click the Execution button and the SMV tool is executed.





Verification > Model Checking (5/6)

5. Click Prop > Verify or Verify all in SMV.



Verification > Model Checking (6/6)

6. Check the verification results and analyze.