Port-Level I/O Protocols Demo Script

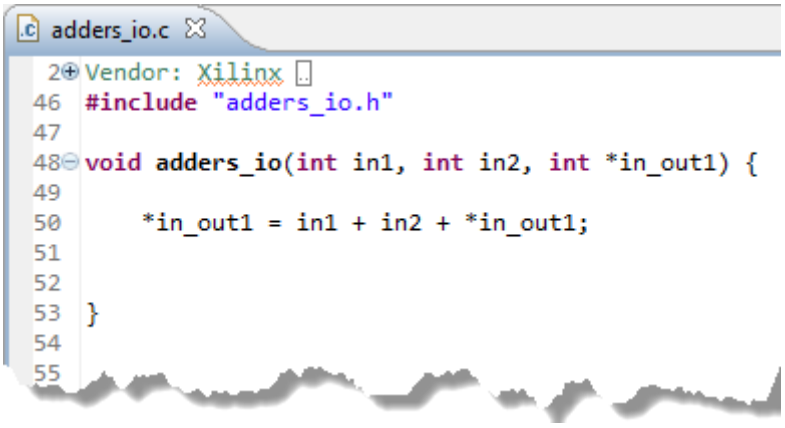
Introduction

This demonstration script provides high-level instructions on how to specify port I/O protocols.

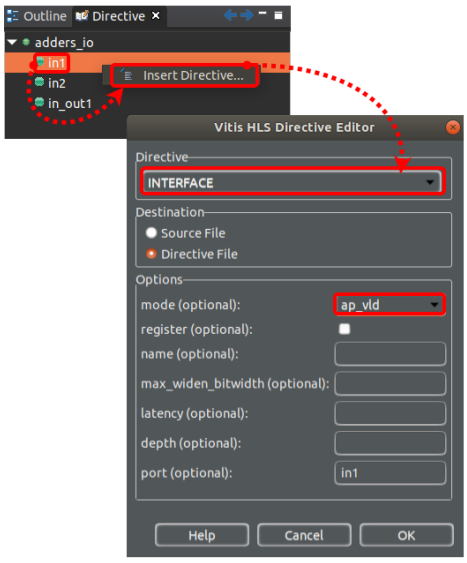
Port-Level I/O Protocols

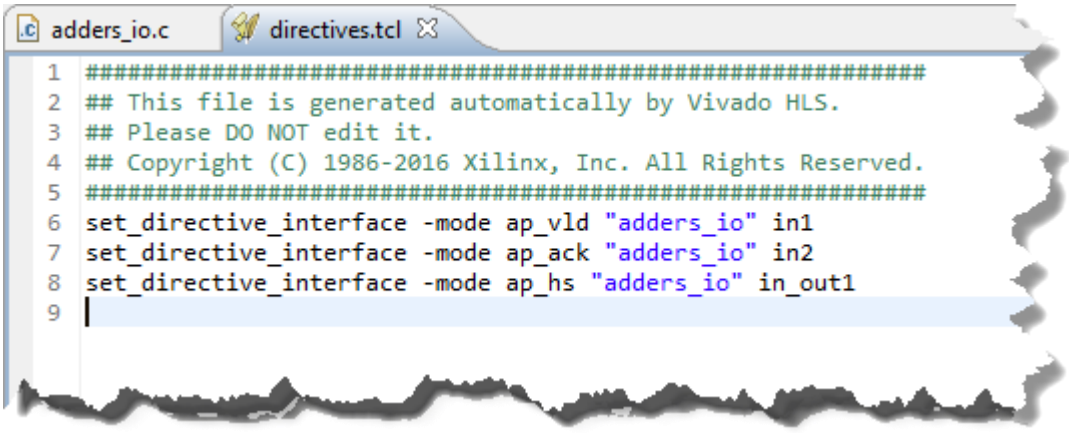
Action with Description	Point of Emphasis and Key Takeaway
• Launch the Vitis™ HLS tool. • Open the provided **adders_io_prj** Vitis HLS project located in the following location: • `C:\Xilinx_trn\HLS2023\lab3_z0`	You can open existing Vitis HLS tool projects from the Vitis HLS tool Welcome page. To open project ***adders_io_prj*** – select *folder* ***adders_io_prj***

Action with Description	Point of Emphasis and Key Takeaway
• Access and review the source file **adders_io.c** from the Explorer pane.	The source code is a very simple code, which helps to focus on the interface behavior and not the core logic. The code does not have a function return, but instead passes the output of the function through the pointer argument `*in_out1`. This also provides the opportunity to explore the interface options for bidirectional (input and output) ports. The pointer argument in this example is both an input and output to the function. In the RTL design, this argument is implemented as separate input and output ports.

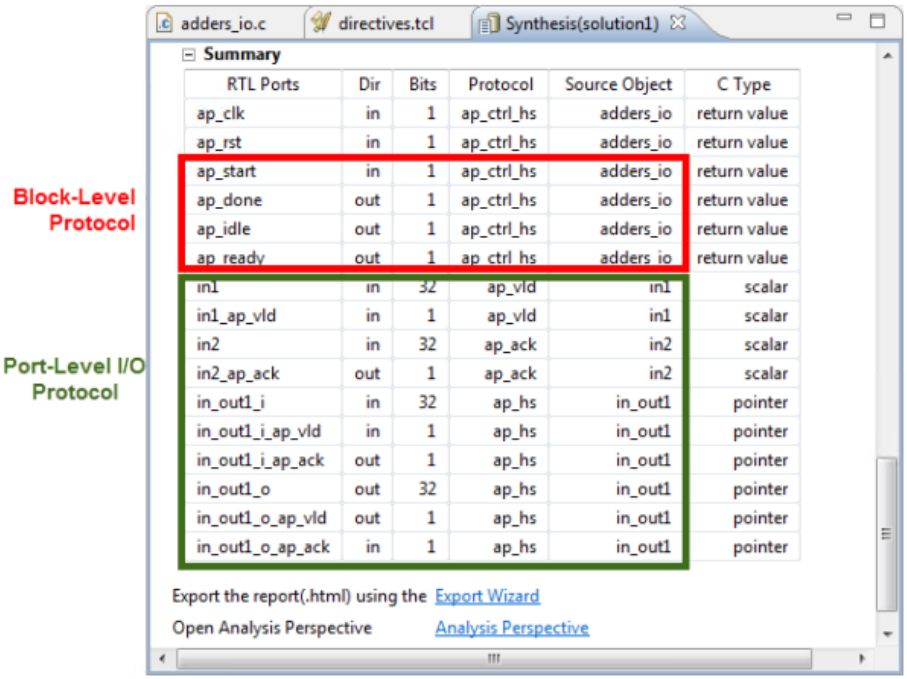


Action with Description	Point of Emphasis and Key Takeaway

• Apply the directive using the GUI and see that the directives have been added to the *directives.tcl* file.
`set_directive_interface -mode ap_vld "adders_io" in1`
`set_directive_interface -mode ap_ack "adders_io" in2`
`set_directive_interface -mode ap_hs "adders_io" in_out1`
	You can apply the directives through the directives.tcl file located under the solutions1 > constraints folder or through the GUI mode.
	Right-click argument **in1** and select **Insert Directive** to choose the **INTERFACE** directive as **ap_vld**.
	Right-click argument **in2** and select **Insert Directive** to choose the **INTERFACE** directive as **ap_ack**.
	Right-click argument **in_out1** and select **Insert Directive** to choose the **INTERFACE** directive as **ap_hs**.
	 

Action with Description	Point of Emphasis and Key Takeaway
• Your directives.tcl file should look like the below one: 	
• Run C synthesis. • Expand the **adders_io_prj** > **solution1** > **syn** > **report** folder in the Explorer pane. • Double-click the **adders_io_csynth.rpt** file to view the Synthesis report. • Review the **Interface Summary** in the Synthesis report.	Note the port-level I/O protocols that are implemented.

Action with Description	Point of Emphasis and Key Takeaway



RTL Ports	Dir	Bits	Protocol	Source Object	C Type
ap_clk	in	1	ap_ctrl_hs	adders_io	return value
ap_rst	in	1	ap_ctrl_hs	adders_io	return value
ap_start	in	1	ap_ctrl_hs	adders_io	return value
ap_done	out	1	ap_ctrl_hs	adders_io	return value
ap_idle	out	1	ap_ctrl_hs	adders_io	return value
ap_ready	out	1	ap_ctrl_hs	adders_io	return value
in1	in	32	ap_vld	in1	scalar
in1_ap_vld	in	1	ap_vld	in1	scalar
in2	in	32	ap_ack	in2	scalar
in2_ap_ack	out	1	ap_ack	in2	scalar
in_out1_i	in	32	ap_hs	in_out1	pointer
in_out1_i_ap_vld	in	1	ap_hs	in_out1	pointer
in_out1_i_ap_ack	out	1	ap_hs	in_out1	pointer
in_out1_o	out	32	ap_hs	in_out1	pointer
in_out1_o_ap_vld	out	1	ap_hs	in_out1	pointer
in_out1_o_ap_ack	in	1	ap_hs	in_out1	pointer

- Explain the Interface summary report:
  - The design has a clock and reset.
  - The default block-level I/O protocol signals are present.
  - Port **in1** is implemented with a data port and an associated input valid signal.
  - The data on port **in1** is only read when port `in1_ap_vld` is active-High.
  - Port **in2** is implemented with a data port and an associated output acknowledge signal.
  - Port `in2_ap_ack` will be active-High when data port `in2` is read.
  - The `inout_i` identifies the input part of argument **inout1**. This has associated input valid port `inout1_i_ap_vld` and output acknowledge port `inout1_i_ap_ack`.
  - The output part of argument **inout1** is identified as `inout_o`. This has associated output valid port `inout1_o_ap_vld` and input acknowledge port `inout1_o_ap_ack`.

- Exit the Vitis HLS tool GUI.

Summary

In this demo, you learned to apply directives for port-level protocols.

References:

- Supporting materials
  - *Vitis High-Level Synthesis User Guide* (UG1399)