

TOE1G-IP Demo on SP605 Instruction

Rev1.1 8-May-19

This document describes the instruction to run TOE1G-IP for transferring data between SP605 development board and PC through Gigabit Ethernet. This demo can select to run with supported and not supported Jumbo frame PC.

1 Environment Setup

As shown in Figure 1-1, to run TOE1G-IP send demo, please prepare

- 1) SP605 Development board
- 2) Xilinx programmer software (iMPACT/Vivado)
- 3) Ethernet cable (Cat5e or Cat6) for network connection between SP605 Development board and PC
- 4) PC with Gigabit Ethernet support
- 5) mini USB cable for programming FPGA between SP605 Development board and PC
- 6) "send_tcp_client.exe" and "recv_tcp_client.exe", provided by Design Gateway, which are test application available on PC

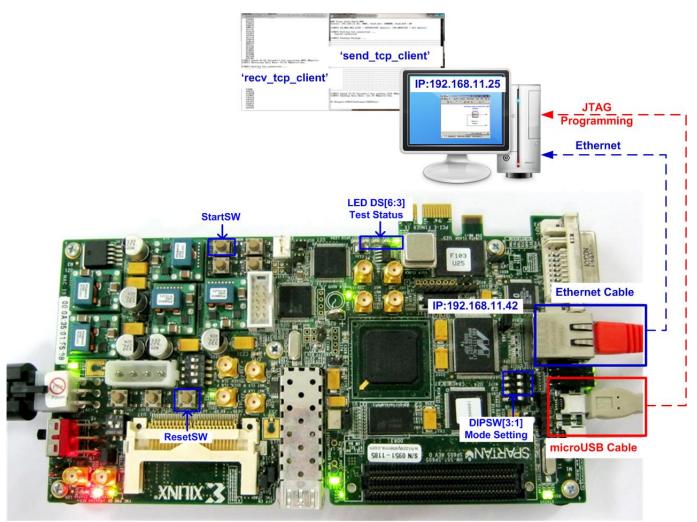


Figure 1-1 TOE1G-IP Demo Environment Setup



2 **Demo description**

There are two test modes, i.e. sending mode and receiving mode between SP605 development board (Server mode) and PC (Client mode). Each test mode uses the different test application on PC and the different DIPSW setting on SP605 development board. The definition of DIPSW and LED on SP605 development board are described in Table 2-1 and Table 2-2.

Note: DIPSW setting must not change during operation.



Figure 2-1 DIPSW Bit1-3 for user input

DIPSW	OFF	ON
Bit 1	Sending mode by using non-Jumbo frame (1460 bytes)	Sending mode by using Jumbo frame (8960 bytes)
Bit 2	Sending mode	Receiving mode
Bit 3	Receiving mode without data verification	Receiving mode with data verification

Table 2-1 DIPSW Setting Definition



Figure 2-2 LED bit0-3 for user output

	ON/BLINK	OFF
DS3 (ON: IP initialize complete	Not complete. Please check that StartSW (SW8) has already been pressed. Also, confirm that IP address setting on PC is correct.
DS4 I	BLINK: Operation timeout or cable lost	Normal operation
DS5	Sending mode in Jumbo frame.	Sending mode in non-jumbo frame.
1	BLINK: data verification is failed in receiving mode ON: Port is established.	No operation

Table 2-2 LED Definition

The step to run sending and receiving test are described as follows.



2.1 Sending mode

In this mode, 4 GB data is transferred from SP605 development board to PC. Also, "recv_tcp_client.exe" application is run on PC for data verification. If received data is not correct, the test application will show error message on console.

User can set two packet sizes by DIPSW[1], i.e. 1460 data byte for non-Jumbo frame mode, and 8960 data byte for Jumbo frame mode. User confirms the setting by monitoring from LED DS5 status.

The operation sequence for sending mode is as follows.

- 1) TOE1G-IP within SP605 development board loads the system parameters such as Packet size, transfer size, MAC and IP address. After that, IP waits open connection from PC.
- 2) Test application on PC opens connection to connect with SP605 development board, and then waits data sending from SP605 board.
- 3) TOE1G-IP starts to send 4 GB data to PC. At the same time, PC verifies that the received data is correct.
- 4) After all data are completely transferred, TOE1G-IP sends packet to close connection.
- 5) PC sends the acknowledge packet to close connection.
- 6) The operation goes back to Step2) to rerun the test as forever loop until the user cancels the operation.

2.2 Receiving mode

In this demo, data is transferred from PC to SP605 development board. By using "send_tcp_client.exe" operating on PC, data is sent out from PC until total data count is equal to the set value. The application can be set as two modes, i.e. dummy mode and increment mode. The test mode of application is the input parameter when calling the application.

The dummy mode is run to check the best performance. All zero data are sent out from PC. At the same time, the verification module within SP605 development board is OFF to read data without verification.

The increment mode is run to verify the data. 32-bit increment data is generated from PC and verification module within SP605 is ON. If data verification is error, DS6 LED will blink. DIPSW[3] is applied to enable verification module.

The operation sequence for receiving mode is as follows.

- 1) Similar to Step 1) in Sending mode.
- Test application on PC opens connection to connect with SP605 development board. Next, the application sends the dummy data or increment data depending on the input mode until total data are completely transferred.
- 3) TOE1G-IP receives data with or without verification, depending on DIPSW[3].
- 4) After all data are completely transferred, Test application closes the connection.
- 5) TOE1G-IP sends acknowledgment to close connection. The operation is completed and not run in forever loop like Sending mode.



3 PC Setup

Before running demo, user needs to setup network setting on PC as follows.

3.1 IP Setting

Local Area Connection Properties		rnet Protocol Version 4 (TCP/IPv4) Properties
Networking Connect using: Intel(R) 82579V Gigabit Network Connection Configure This connection uses the following items: Client for Microsoft Networks QoS Packet Scheduler	۲ t	Ineral You can get IP settings assigned autor his capability. Otherwise, you need to or the appropriate IP settings. O Obtain an IP address automatication O Use the following IP address: IP address:	ally
		Sybnet mask: Default gateway:	255 , 255 , 255 , 0
Install Uninstall Properties Description		Use the following DNS server ad Preferred DNS server: Alternate DNS server:	ldresses:
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.		Vaļidate settings upon exit	Ad <u>v</u> anced OK Cancel

Figure 3-1 IPv4 Setting

- Open Local Area Connection Properties of test connection, as shown in the left window of Figure 3-1.
- Select "TCP/IPv4" and then click Properties.
- Set IP address = 192.168.11.25 and Subnet mask = 255.255.255.0, as shown in the right window of Figure 3-1.



3.2 Speed and Frame Setting

🖟 Local Area Connection Properties 🛛 🛛 🕰	Local Area Connection
Networking Connect using:	You have made changes to the properties of this connection. If you proceed your changes will be lost. Do you wish to proceed? Yes <u>No</u>
Link-Layer Topology Discovery Responder Install Uninstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks. OK Cancel	

Figure 3-2 Network Configure

- On Local Area Connection Properties window, click "Configure", as shown in Figure 3-2.
- On Advance tab, Jumbo Packet = 9014 Bytes to enable jumbo frame, as shown in Figure 3-3.

tel(R) 82579V Gigabit Network	Conn	ection Prop	perties	×	
Teaming VLANs		Drive	r	Details	
General Link Speed	Ad	vanced	Pow	er Management	
Advanced Adapter Settings					
Settings:		Valu			
Gigabit Master Slave Mode Interrupt Moderation		<u>~</u> 90	14 Bytes	s v	
Jumbo Packet		=			
Large Send Offload (IPv4)					
Large Send Offload (IPv6) Locally Administered Address					
Log Link State Event					
Performance Options		*	Use	<u>D</u> efault	
Jumbo Packet					
Enables Jumbo Packet capability for TCP/IP packets. In situations where large packets make up the majority of traffic and additional latency can be tolerated, Jumbo Packets can reduce CPU utilization and improve wire efficiency.					
Jumbo Packets are larger than standard Ethernet frames, which are approximately 1.5k in size.					
Note: Changing this so loss of connectivity.	setting	may cause	a mome	entary T	
			ОК	Cancel	

Figure 3-3 Jumbo Frame Setting



- On Link Speed tab, select "1.0 Gbps Full Duplex" for running Gigabit transfer test, as shown in the left window of Figure 3-4.
- On Advance tab, Settings=Interrupt Moderation and Value= "Enabled", as shown in the right window of Figure 3-4.

Intel(R) 82579V Gigabit Network Connection Properties	Intel(R) 82579V Gigabit Network Connection Properties
Teaming VLANs Driver Details	Teaming VLANs Driver Details
General Link Speed Advanced Power Management	General Link Speed Advanced Power Management
Link Speed and Duplex Settings Intel(R) PROSet Version: 17.2.154.0 Link Status Speed: 1.0Gbps/Full Duplex (EEE Capable)	Advanced Adapter Settings
Speed and Duplex:	Gigabit Master Slave Mode
	Interrupt Moderation Jumbo Packet Large Send Offload (IPv4) Large Send Offload (IPv6) Locally Administered Address Log Link State Event Performance Options Use Default Interrupt Moderation
If the adapter fails to connect, you can set the speed and duplex settings to match those of the link partner. EEE Enabled: Displays "EEE Enabled" if this device has negotiated an Energy Efficient Ethernet link with its link partner. Temperature: Displays temperature state if the adapter has a temperature sector	Allow s the adapter to moderate interrupts. When a packet arrives, the adapter generates an interrupt, w hich allow s the driver to handle the packet. At greater link speeds, more interrupts are created, and CPU utilization also increases. This results in poor system performance. When you enable Interrupt Moderation, the interrupt rate is low er, and the result is better system performance. NOTE: Changing this setting may cause a momentary
OK Cancel	OK Cancel

Figure 3-4 Link speed and Jumbo frame setup

- For Intel LAN controller, Performance Options in "Advanced" tab should be set to achieve the good performance as shown in Figure 3-5. "Interrupt Moderation Rate" in <u>"Performance Options" windows is recommended to set as "Off"</u>.

Advanced Adapter Settings Settings: Value: Adaptive Inter-Frame Spacing Flow Control Off Settings: Interrupt Moderation Rate Interrupt Moderation Jumbo Packet Large Send Offload (IPv4) Properties Use Default Interrupt Moderation Rate	Teaming VLANs Driver Details General Link Speed Advanced Power Management
Locally Administered Address Locally Administered Address Locally Administered Address Performance Options Performance Options Configures the adapter to use settings that can improve adapter performance. Without interrupt moderation, CPU utilization increases at higher data rates because the system must handle a larger number of OK	ettings: Interrupt Moderation Jumbo Packet Large Send Offload (IPv4) Large Send Offload (IPv6) Locally Administered Address Log Link State Event Performance Options Promy & VLAN Performance Options Configures the adapter to use settings that can improve adapter
OK Cancel	OK Cancel



4 How to run demo

The following sequence is recommended to setup the hardware before running the test.

- 1) Power off system
- 2) Connect mini USB cable from SP605 development board to PC.
- 3) Connect power supply to SP605 board.
- 4) Connect Ethernet cable between SP605 development board and PC.
- 5) Set up network setting on PC following Topic 0.
- 6) Power on SP605 development board.
- 7) Open Xilinx programmer (iMPACT) and download "toe1giptest.bit" to SP605 development board, as shown in Figure 4-1.

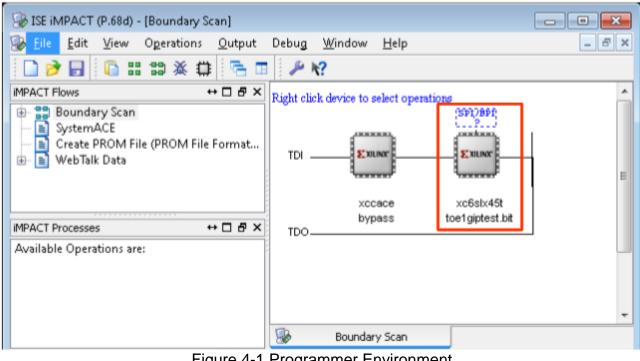


Figure 4-1 Programmer Environment

- 8) Check LED status on SP605 development board now and LED DS[6:3] are all OFF.
- 9) Check link status of PHY at LED 1000 (near RJ45). LED 1000 must be ON to show that 1Gb Ethernet link is ready, as shown in Figure 4-2.



Figure 4-2 Link Status LED from PHY chip



10)Press StartSW as shown in Figure 1-1 (SW8) to start the system initialization. 11)DS3 LED must turn on while DS5 LED status depends on DIPSW[1] setting.



Figure 4-3 LED Status after press StartSW when DIPSW[1]=OFF



Figure 4-4 LED Status after press StartSW when DIPSW[1]=ON

Now system is ready for the test. The step to test Sending and Receiving data is described in next topic.

<u>Note:</u> Transfer performance on the demo depends on Test PC performance to send and receive data through Gigabit Ethernet



4.1 Run Sending Demo

Sending demo is operated as forever loop. The user needs to cancel the application to stop the test.

- 4.1.1 Non-Jumbo frame mode
 - Set DIPSW[2] = OFF to run Sending demo.
 - Set DIPSW[1] = OFF and confirm that DS5 LED is OFF.
 - Open "command prompt" on PC, and run "recv_tcp_client" application by following command

>> recv_tcp_client <FPGA IP address> <FPGA port number> <number of data in packet> For example,

>> recv_tcp_client 192.168.11.42 4000 1460

<u>Note</u>: The parameters in the demo are fixed. So, IP address, port number, and the numbers of data could not be changed. To update some parameters, it needs to modify HDL code in the reference design.

- During running, Test application displays total received data every second. After finishing each loop, time usage and the performance are displayed, as shown in Figure 4-5.
- User can cancel operation by pressing "Ctrl+C".

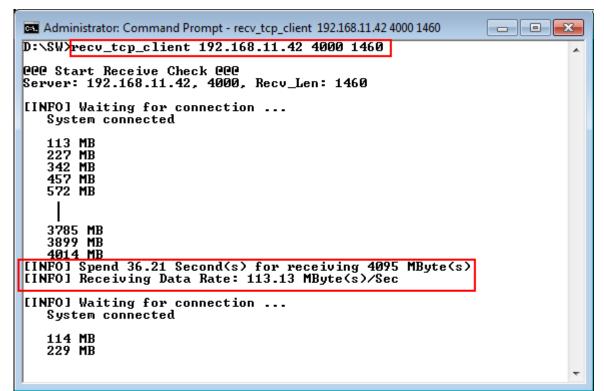


Figure 4-5 Non-Jumbo frame Sending Demo



Figure 4-6 LED Status when running Sending Demo with Non-Jumbo frame



- 4.1.2 Jumbo frame mode
 - Set DIPSW[2] = OFF to run Sending demo.
 - Set DIPSW[1] = ON and confirm that DS5 LED is ON.
 - Open "command prompt" on PC, and run "recv_tcp_client" application by following command

>> recv_tcp_client 192.168.11.42 4000 8960

<u>Note:</u> The parameters in the demo are fixed. So, IP address, port number, and the numbers of data could not be changed. To update some parameters, it needs to modify HDL code in the reference design.

- The message on the console during running the test is same as non-jumbo frame mode.

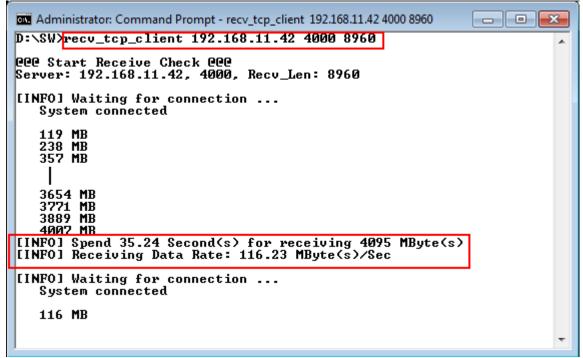


Figure 4-7 Jumbo frame Sending Demo



Figure 4-8 LED Status when running Sending Demo with Jumbo frame



4.2 Run Receiving Demo

- 4.2.1 Dummy data mode
 - Set DIPSW[2] = ON to run Receiving demo.
 - Set DIPSW[3] = OFF to disable data verification module in SP605.
 - Open "command prompt" on PC, and run "send_tcp_client" application by following command

>> send_tcp_client <FPGA IP address> <FPGA port number> <transfer size in 16kbyte unit> <mode>

- Similar to Sending demo, IP address and port number cannot change without HDL code modification.
- User sets transfer size in 16kByte unit which is the buffer size in test application. For example, 100000 is equal to 1600 Mbyte size. The valid range of transfer size is 1 – 262143.
- Mode: '0'- All '0' pattern is sent as dummy data.

For example,

>> send_tcp_client 192.168.11.42 4000 100000 0

- Test application displays "..." during sending the data. Time usage and test performance are displayed as a test result after finishing transferring all data, as shown in Figure 4-10.

👞 Administrator: Command Prompt		3
C:\SW> <mark>send_tcp_client 192.168.11.42 4000 100000</mark>	0_	^ +
•	Þ	
Figure 4-9 Command line for receiving demo on dum	my data mod	de

🔤 Administrator: Command Prompt 🦳	, • 🔀
200 Start Send Check 200 Server: 192.168.11.42, 4000, Send_Cnt: 100000, Send_Vrf: DIS	^
[INFO] Waiting for connection System connected	
[INFO] Sending Package	
[INFO] Spend 13.82 Second(s) for sending 1562 MByte(s)	
[INFO] Sending Data Rate: 113.05 MByte(s)/Sec	
1	T

Figure 4-10 Receiving Demo on dummy data mode



4.2.2 Verification mode

- Set DIPSW[2] = ON to run Receiving demo.
- Set DIPSW[3] = ON to enable verification module in SP605.
- Open "command prompt" on PC, and run "send_tcp_client" application by following command

>> send_tcp_client <FPGA IP address> <FPGA port number> <transfer size in 16kbyte unit> <mode>

- Similar to Sending demo, IP address and port number cannot change without HDL code modification.
- User sets transfer size in 16kByte unit which is buffer size in test application. For example, 100000 is equal to 1600 Mbyte size. The valid range of transfer size is 1 – 262143.
- Mode: '1'- 32-bit increment data is sent to verify data by SP605.

>> send_tcp_client 192.168.11.42 4000 100000 1

- Test application displays "..." during sending the data. Time usage and test performance are displayed as a test result after finishing transferring all data, as shown in Figure 4-11.

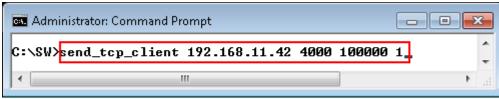


Figure 4-11 Command line for receiving demo on increment data mode

🔤 Administrator: Command Prompt	×
PCC Start Send Check PCC Server: 192.168.11.42, 4000, Send_Cnt: 100000, Send_Vrf: EN	
[INFO] Waiting for connection System connected	
[INFO] Sending Package	
[INFO] Spend 14.15 Second(s) for sending 1562 MByte(s) [INFO] Sending Data Rate: 110.43 MByte(s)/Sec	
	-

Figure 4-12 Receiving Demo on increment data mode

- DS6 LED will blink if some received data is error, detected by Verification module in SP605.

For example,



5 Revision History

Revision	Date	Description
1.0	11-Dec-12	Initial version release
1.1	8-May-19	Rename TOE2-IP to TOE1G-IP