

TOE10G-IP Demo on VC707 Instruction

Rev1.0 13-Jun-14

This document describes the instruction to run TOE10G-IP for transferring 10-Gb data between VC707 development board and PC through 10Gigabit Ethernet. This demo can select to run with supported and not supported Jumbo frame PC.

1 Environment Setup

As shown in Figure 1, to run TOE10G-IP send demo, please prepare

- 1) VC707 Development board
- 2) PC with 10Gigabit Ethernet support or 10Gigabit Ethernet card
- 2x10-Gigabit SFP+ Transceiver with Optical cable for network connection between VC707 Development board and PC
- 4) micro USB cable for programming FPGA between VC707 Development board and PC
- 5) "send_tcp_client_10G.exe" and "recv_tcp_client_10G.exe", provided by Design Gateway, which are test application available on PC

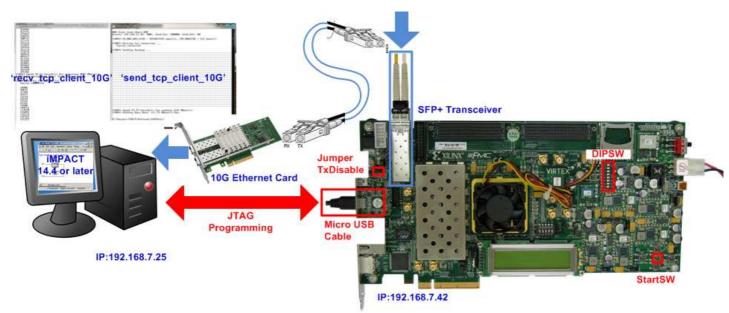


Figure 1 TOE10G-IP Demo Environment Setup

Note: Test result in this document is captured by using following test environment.

[1] 10G Network Adapter: Intel X520-DA2

http://www.intel.com/content/www/us/en/network-adapters/converged-network-adapters/ ethernet-x520-server-adapters-brief.html

- [2] 10-Gigabit SFP+ Transceiver: Avago AFBR-703SDZ http://www.avagotech.com/pages/en/fiber_optics/ethernet/10_gbe/afbr-703sdz/
- [3] Fiber Optical Cable: TE Connectivity 2105027-3 http://www.te.com/catalog/pn/en/2105027-3
- [4] PC: Motherboard ASUS P8Z77-V, 8 GB RAM, 64-bit Windows7 OS



2 Demo description

There are two test modes, i.e. sending mode and receiving mode between VC707 development board, running as TCP Server, and PC which running as TCP Client. Each transfer mode requires different test application on PC and different DIPSW setting on VC707 development board. The definition of DIPSW and LED on VC707 development board are described in Table 1 and Table 2.

Table 1 DIPSW Setting Definition

DIPSW	OFF	ON		
Bit 1	Sending mode by using non-Jumbo frame (1456 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 LED Definition

GPIO LED	ON/BLINK	OFF
0	ON: IP initialize complete	Not complete. Please check that StartSW (SW6-CenterSW) has already been pressed and confirm IP address setting on PC that is correct.
1	BLINK: Operation timeout or cable lost	Normal operation
2	Sending mode in Jumbo frame.	Sending mode in non-jumbo frame
3	BLINK: data verification is fail in receiving mode ON: Port is established.	No operation

Note:

- DIPSW setting must not be changed during operation.

More details about each test mode are follows.



2.1 Sending mode

In this mode, 32 GB data will be transferred from VC707 development board to PC, and "recv_tcp_client_10G.exe" application will operate on PC for data verification. If data value is not correct, test application will show error message on console.

User can select 2 transfer packet sizes by DIPSW[1] setting, i.e. 1456 data byte for running with not supported Jumbo frame PC, and 8960 data byte for running with supported Jumbo frame PC. User can confirm this setting from LED2 status.

The operation sequence for sending mode is follows.

- 1) TOE10G-IP within VC707 development board initializes parameters in system such as Packet size, transfer size, MAC and IP address, and then waits open connection from PC.
- 2) Test application on PC opens connection to connect with VC707 development board, and wait data sending.
- 3) TOE10G-IP starts to send 32 GB data to PC while PC verifies receiving data that is correct.
- 4) After all data are transferred, TOE10G-IP sends packet to close connection.
- 5) PC sends acknowledge to close connection. Then, operation will run as loop from Step2) to Step5) until operation cancelled.

2.2 Receiving mode

In this demo, data will be transferred from PC to VC707 development board. By using "send_tcp_client_10G.exe" operating on PC, data will be sent out until number of transferred data equal to setting value. This test can run as 2 modes, i.e. performance test and data verification.

In performance test, all '0' data will be sent out from PC and verification module within VC707 development board will be OFF for achieving best performance transfer. In data verification mode, 32-bit increment data will be generated from PC and verification module will be ON for data verification. LED error will blink if any error is detected. Verification ON/OFF within hardware is set from DIPSW[3] while test application can be set as option value in command line.

The operation sequence for receiving mode is follows.

- 1) Similar to Step 1) in Sending mode.
- 2) Test application on PC opens connection to connect with VC707 development board, and then start transferring all '0' or increment data out until complete.
- 3) TOE10G-IP receives data and verify data if enable.
- 4) After all data are transferred, Test application sends packet to close connection.
- 5) TOE10G-IP sends acknowledge to close connection. This mode will run only 1 time, not in repeat loop like Sending mode.



3 PC Setup

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

3.1 IP Setting

Connect using: 10-Gb LAN connection Intel(R) Ethemet Server Adapter X520-2		automatically if your network suppor eed to ask your network administrato
Configure	💿 Qbtain an IP address autom	natically
This connection uses the following items:	 Use the following IP address 	s:]
 ✓ User for Microsoft Networks ✓ Oo SPacket Scheduler 	IP address:	192.168.7.25
Registration of the second secon	Subnet mask:	255 . 255 . 255 . 0
	Default gateway:	
	Obtain DNS server address	automatically
	Use the following DNS serve	
Install Uninstall Properties	Preferred DNS server:	· · · ·
Description	Alternate DNS server:	
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.	Validate settings upon exit	Adyanced.

Figure 2 IPv4 Setting

- Open Local Area Connection Properties of 10-Gb connection, as shown in left window of Figure 2.
- Select "TCP/IPv4" and then click Properties.
- Set IP address = 192.168.7.25, and Subnet mask = 255.255.255.0, as shown in right window of Figure 2.



3.2 Speed and Frame Setting

Local Area Connection 2 Properties	Local Area Connection 2
Networking Sharing Connect using: Intel(R) Ethemet Server Adapter X520-2	You have made changes to the properties of this connection. If you proceed your changes will be lost. Do you wish to proceed?
This connection uses the following items:	<u>Yes</u> <u>N</u> o
Install Uninstall Properties Description Allows your computer to access resources on a Microsoft network.	
OK Cancel	

- -
 - On Local Area Connection Properties window, select "Client for Microsoft Networks", and then click "Configure", as shown in Figure 3.



	Boot Options	Driver	Details	VLANs	Boot Options	Driver	Details
General	Link Speed	Advanced	Teaming	General	Link Speed	Advanced	Teaming
ofile: Sta ttings:	Advanced Adapter Se	▼ Value:		Link Status Speed:	Link Speed and Duple Intel(R) PROSet Versio 10.00 Gbps/Full	in: 19.1.51.0	
umbo Packet	load V2 (IPv4)	9014 Bytes Disabled		Speed and Du		Ċ	
arge Send Off	load V2 (IPv6)	# 4088 Bytes 9014 Bytes		10 Gbps Full D Auto Negotiati	for merce and	<u>D</u> iagno	ostics
ocally Adminis og Link State erformance Oj riority & VLAN	ptions		Default	10 Gbps Full D		Identify /	Adapter
umbo Packet					Duplex Setting: By de ally detect and negotiate		
where large p	o Packet capability for backets make up the ma	ajority of traffic and		A setting oth	er than Auto Negotiation uring auto-negotiation.		
	ncy can be tolerated, J and improve wire efficient		educe	Temperature	re: Displays temperatur	e state if the adapt	er has a
	ts are larger than stand ately 1.5k in size.	lard Ethernet frames	which	SFP+ Modu			
	E: Changing this setting of connectivity.	g may cause a mome	entary				

Figure 4 Link speed and Jumbo frame setup

- On Advanced Tab, select "Jumbo Packet" and then set Value to "9014 Bytes" for Jumbo Frame support or set value to "Disabled" for non-Jumbo Frame support, as shown in left window of Figure 4.
- On Link Speed, select "10 Gbps Full Duplex" for running 10-Gigabit transfer test, as shown in right window of Figure 4.



Ineral Link Speed Advanced Teaming Flow Control Internet Moderation Rate Idvanced Adapter Settings Standard Server Is: Ipt Moderation Properties Internet Moderation Rate Idvanced Adapter Settings Is: Internet Moderation Properties Internet Moderation Properties Internet Moderation Internet Moderation Properties Internet Moderation Internet Moderation Properties Internet Moderation	VLANs	Boot Options	Driver	Details	Set	ings:	
S: pp Moderation properties Properties	neral			Teaming	Flo	v Control errupt Moderation Rate v Latency Interrupts ceive Buffers	Propertie
pt Moderation P acket Send Offload V2 (IPV4) Send Offload V2 (IPV6) y Administered Address ink State Event mance Options figures the adapter to use settings that can improve adapter ormance. OK Cancel Configures which packets bypass interrupt moderation and tigger immediate interrupts. Use for packets with TCP PsH flag will trigger an immediate interrupt. The PSH flag will trigger an immediate interrupt.		ndard Server	:*			and the second	
OK Cancel OK Cancel OK Cancel Add New Port:	o Packet Send Offle Send Offle ly Administ Jink State B	oad V2 (IPv4) oad V2 (IPv6) ered Address Event tions		perties	9 ti V	enerate an interrupt when ce he system to handle the pack rill have faster access to net ata latency. NOTES: • If this option is en-	ertain TCP packets arrive, allow et more quickly. Certain applica work data because of the redu
trigger immediate interrupts. Use for packets with TCP Any incoming packet with th PSH flag: TCP PSH flag will trigger an immediate interrupt. The PSH flag is set by the sending	Contraction of the		gs that can improve	adapter	L		
	figures the			_		Use Low Latency Interru	Add New Port:

Figure 5 Performance Options

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- On Advanced Tab, select "Performance Options" and click "Properties" button. On "Performance Options" window, select "Low Latency Interrupts" and click "Properties" button.
- On "Low Latency Interrupts" window, select "Use Low Latency Interrupts" and click "OK" button.
- Click "OK" button to save and exit all setting windows. -

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4 How to run demo

Both Sending and Receiving demo requires same initial steps to set up hardware as follows.

- Insert Jumper to pin1-2 at J6 connector to enable SFP+, as shown in Figure 6.



- Connect micro USB cable from VC707 development board to PC, and connect power supply to VC707 board.

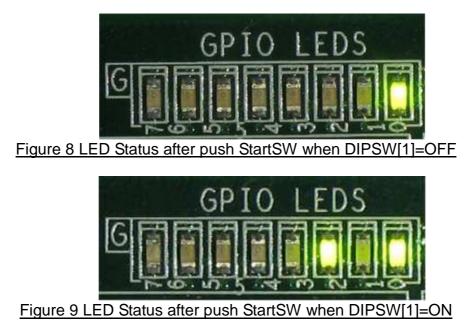
- Insert SFP+ transceiver with optical cable to SFP on KC705.
- Insert another SFP+ transceiver with optical cable to PC.
- Set up network setting on PC, following Topic 3.
- Power on VC707 development board.
- Open iMPACT and download bit file to VC707 development board, as shown in Figure 7.

SE IMPACT (P.68d) - [Boundary Scan]	
Eile Edit View Operations Output	Debug Window Help
🗋 🏓 🖥 🧯 🖀 🖬 🚺	P N?
iMPACT Flows ↔ □ 문 ×	Right click device to select operations
 Boundary Scan SystemACE Create PROM File (PROM File Format WebTalk Data 	
iMPACT Processes ↔	toe10gtest.bit TDO
Available Operations are:	
	Boundary Scan
Console	+□₽×
<pre>'1': Loading file 'D:/TOE10G_1 done. <</pre>	IP/Test/2014.1/SFPOnBoard/TOE10GTest_VC
	Configuration Digilent JTAG-SMT1 10000000

Figure 7 Programmer Environment



- Press StartSW as shown in Figure 1(SW6) to initialize parameter in system, and then LED0 will turn on, as shown in Figure 8 and Figure 9 following DIPSW[1] setting.



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

Note:

- Transfer performance on the demo depends on Test PC performance to send and receive data through 10-Gigabit Ethernet



4.1 Run Sending Demo

Sending demo will operate in loop and user needs to cancel the application to stop the test, so the logic will hang to wait TestPC acknowledge.

- 4.1.1 Non-Jumbo frame mode
 - Set DIPSW[2] = OFF to run Sending demo.
 - Set DIPSW[1] = OFF and confirm that LED2 status is OFF.
 - Open "command prompt" on PC, and run "recv_tcp_client_10G" test application by following command

>> recv_tcp_client_10G <FPGA IP address> <FPGA port number> <number of data in packet>

For example,

>> recv_tcp_client_10G 192.168.7.42 4000 1456

Note: This demo fixes IP address, port number, and number of data. So, please don't change any value without vhdl code modification.

- Test application displays current packet number during transferring and time usage with performance will be displayed when complete each loop transfer, as shown in Figure 10.
- User can cancel operation by pressing "Ctrl+C".

Administrator: C:\Windows\system32\cmd.exe - recv_tcp_client_10G 192.168.7.42 4000 1456	×
C:\SW> <mark>recv_tcp_client_10G 192.168.7.42 4000 1456</mark>	Â
000 Start Receive Check 000 Server: 192.168.7.42, 4000, Recv_Len: 1456	
[INFO] Waiting for connection System connected	
1062050 kByte(s) 2095 MByte(s) 3188 MByte(s) 4329 MByte(s)	
29794 MByte(s) 30895 MByte(s) 31953 MBute(s)	
[INFO] Spend 31.40 Second(s) for receiving 32767 MByte(s) [INFO] Receiving Data Rate: 1094.19 MByte(s)/Sec	
[INFO] Waiting for connection System connected 1051344 kByte(s)	
1631 MByte(s)	

Figure 10 Non-Jumbo frame Sending Demo



Figure 11 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 LED status is ON.
- Open "command prompt" on PC, and run "recv_tcp_client_10G" test application by following command

>> recv_tcp_client_10G 192.168.7.42 4000 8960

Note: This demo fixes IP address, port number, and number of data. So, please don't change any value without vhdl code modification.

- Test application displays current packet number during transferring and time usage with performance will be displayed when complete each loop transfer, as shown in Figure 12.
- User can cancel operation by pressing "Ctrl+C".

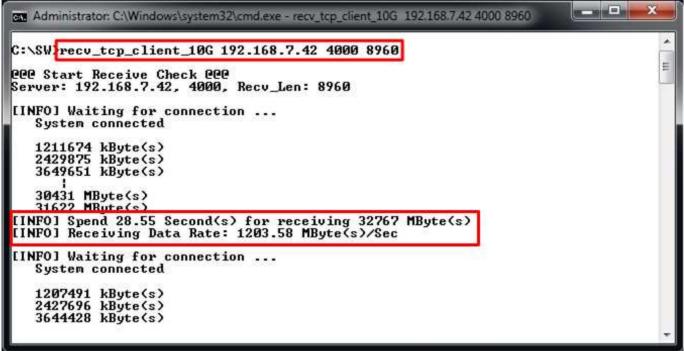


Figure 12 Jumbo frame Sending Demo

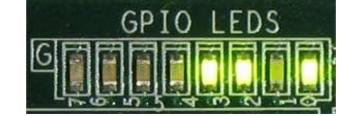


Figure 13 LED Status when running Sending Demo with Jumbo frame

4.2 Run Receiving Demo

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- 4.2.1 Performance test mode
 - Set DIPSW[2] = ON to run Receiving demo.
 - Set DIPSW[3] = OFF.
 - Open "command prompt" on PC, and run "send_tcp_client_10G" test application by following command

>> send_tcp_client_10G <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 can set transfer size in 16kByte unit which is buffer size in test application. In this example, 2097152 means 32 GBytes data is transferred. Valid range of transfer size is 1 – 2097152.
- Mode: '0'- All '0' pattern are sent for performance test.

For example,

>> send_tcp_client_10G 192.168.7.42 4000 2097152 0

- Test application displays "..." during transferring packet and time usage with performance will be displayed when complete data transfer, as shown in Figure 15.

Administrator: C:\Windows\system32\cmd.exe	
C:\SW <mark>]send_tcp_client_10G 192.168.7.42 4000 2097152 0</mark>	^
• [m	

Figure 14 Command line for receiving demo on Performance test mode

an Administrator: C:\Windows\system32\cmd.exe
CCC Stant Send Check GGG
Server: 192.168.7.42, 4000, Send_Cnt: 2097152, Send_Vrf: DIS
[INFO] Waiting for connection System connected
[INFO] Sending Package
[INFO] Spend 28.11 Second(s) for sending 32768 MByte(s) [INFO] Sending Data Rate: 1222.24 MByte(s)/Sec

Figure 15 Receiving Demo on Performance test mode



4.2.2 Verification mode

- Set DIPSW[2] = ON to run Receiving demo.
- Set DIPSW[3] = ON to enable verification module.
- Open "command prompt" on PC, and run "send_tcp_client_10G" test application by following command

>> send_tcp_client_10G <FPGA IP address> <FPGA port number> <transfer size in 16kbyte unit> <mode>

- Similar to Sending demo, IP address and port number cannot change without vhdl code modification.
- User can set transfer size in 16kByte unit which is buffer size in test application. In this example, 100000 means 32 Gbytes data is transferred. Valid range of transfer size is 1 – 2097152.
- o Mode: '1'- 32-bit increment data are sent for data verification.

For example,

>> send_tcp_client_10G 192.168.7.42 4000 2097152 1

- Test application displays "..." during transferring packet and time usage with performance will be displayed when complete data transfer, as shown in Figure 17.

Administrator: C:\Windows\system32\cmd.exe	
C:\SW <mark>.send_tcp_client_10G 192.168.7.42 4000 2097152 1</mark>	A -

Figure 16 Command line for receiving demo on Verification mode

en Admin	istrator: C:\Windows\sys	em32\cmd.exe			
CCC Sta	et Send Check PP(0		1.07	-
Server:	192.168.7.42, 40	100, Send_Cnt: 20	97152, Send_Urf:	EN	
[INFO] Syst	Waiting for conne em connected	ction			
[INF0]	Sending Package				
INF01	Spend 28.28 Secon Sending Data Rate	d(s) for sending : 1214.85 MByte(s	32768 MByte(s) s)/Sec		
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Figure 17 Receiving Demo on Verification mode

- LED3 will blink if any error data detects from Verification module.



5 Revision History

Revision	Date	Description
1.0	13-Jun-14	Initial version release