

Procedure manual of TOE-IP demo design

Rev2.2 12/9/2010

This document describes about procedure to operate TCP Off-load Engine IP Core demo design.

1. Environment

This demo design is based on the following environment as shown in Figure1.

1. Xilinx FPGA evaluation board(ML506, ML605, SP605 or Spartan3A DSP 1800 board)
2. Xilinx Platform cable USB
3. PC has Gigabit Ethernet Port for receiving TCP data. (Recommended spec is dual core processor over 2GHz.)
4. Serial cable
5. Ethernet cable (Cat5e or Cat6)

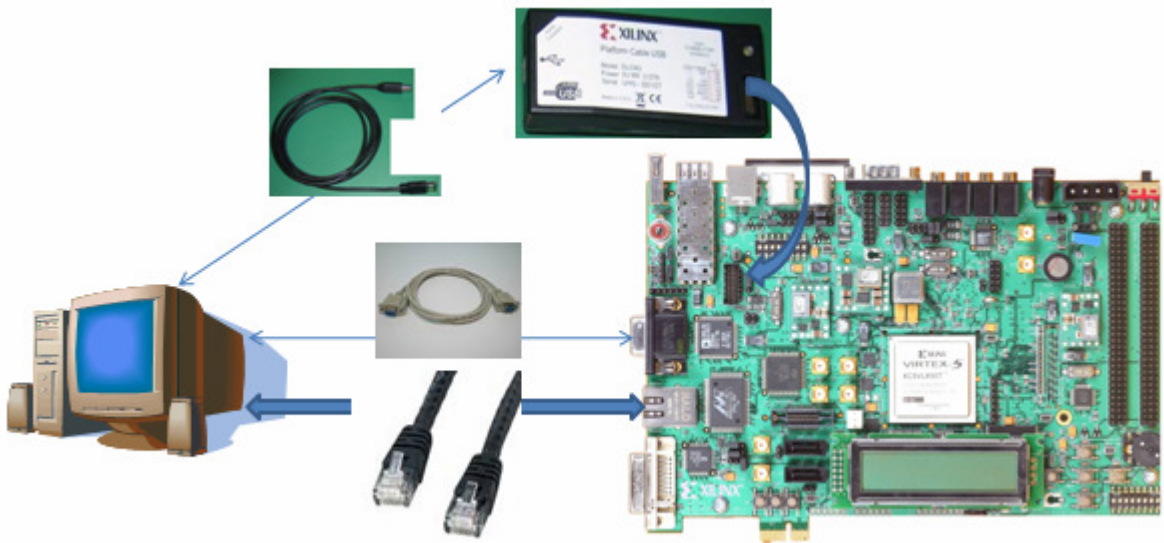


Figure 1: Demo design operation environment

2. Specification of demo design

Specification of this demo design is as follows.

- Assume 1 to1 connection.
- Support ARP and TCP data transmission.
- Support passive open.
- Support active close for fast connection and passive close for slow connection and force close by RST.
- Support 1 connection for fast connection. (sending only)
- No limit number of slow connections as long as memory is enough. (default 9 connections)
- Support sending and receiving data for slow connection.

3. Operation of demo design

The operation of this demo design is as follows.

1. Send ARP Request and get MAC address of the transmit destination.
2. Wait request of TCP connection
3. Execute data transmit in case of fast transmit connection is opened. When all data transmit is completed, it closes TCP connection and go back to the state of waiting request of TCP connection.
4. Receive data and verify and echo back in case of slow transmit connection is opened. When connection is closed, go back to the state of waiting request of TCP connection.
5. Repeat 2 – 4.

User can set MSS and TX window buffer size in serial console.

The data transmitted in fast connection is 32bit data incremented 1 each 365 words(1460 bytes). In case of MSS is set 1460 and retransmit do not occur, one TCP packet is filled with same data and next TCP packet is filled with the data incremented 1.

“recv_tcp_client” is PC program for fast connection to receive and check data. This program checks whether the data is same each 365 words and next data is incremented 1, so user can check data corruption and packet lost.

(Of course these error should not occur because TCP is data safe protocol.)

“echo_tcp_client” is PC program for slow connection. This program is executed and given port number and speed of sending data in command prompt as follow.

```
echo_tcp_client <port number> <packet number to send each 1 second>
```

Each packet has 16 bytes data and its data is incremented 1 each packet. After that, this program receives data and compare sent data. If the data is not same, this program outputs error message. When 128 packets (128×16=2048 bytes) are received, this program closes current connection and open new connection.

Please refer C source codes for detail.

4. Operation of procedure

1. Connection of PC and FPGA evaluation board. (Refer Figure 1)
 - Connect Gigabit Ethernet port of PC and RJ45 connector of FPGA evaluation board by Ethernet cable.
 - Connect Platform cable USB to PC and JTAG connector of FPGA evaluation board.
 - Connect serial port of PC and FPGA evaluation board by serial cable.
(In case of ML50x, user has to use cross serial cable.)
 - Connect AC adapter to FPGA evaluation board and power on the switch.
2. Settings of PC
 - Set IP address as “192.168.0.34” and subnet mask as “255.255.255.0”.
 - Launch serial console such as hyper terminal and set 115200bps, no parity, no flow control.
3. Downloading bit file
 - Download “download.bit” to FPGA by iMPACT.
4. Input MSS and TX window buffer size when the message is displayed in serial console. MSS can be set 500 – 16000 and TX window buffer can be set MSS – 65000. In case of MSS is set over 1460, notice PC and switching hub can support Jumbo Frame.
5. Execute `recv_tcp_client.exe` in DOS prompt.

Receive operation starts after a while and display the number each 1 second. This number means received packets number as 1 packet is 1460 bytes. After about 4GB data is received, this program displays transmission time.

If packet drop occurs, “drop <expected data> <received data>” is displayed and transmission is stopped. If data corruption occurs, “data error <expected data> <received data> <location in packet>” is displayed and transmission is stopped. Please refer “`recv_tcp_client.c`” for detail.

This program is stopped by entering “ctrl+c”.

User can check multi-connection by executing “`echo_tcp_client.exe`”. Demo design is waiting 9 ports “60001 – 60009”. User can transmit data in slow connection by executing such as `echo_tcp_client 60001 1` during fast connection is operating. This means connect port 60001 and send 1 packet(16 bytes) each 1 second.

For opening further connection, execute “`echo_tcp_client.exe`” in other DOS prompt. In this time, user have to use other port number.

Demo design verifies data in slow connection. If data error occurs, error message is displayed in serial console and transmission is stopped.

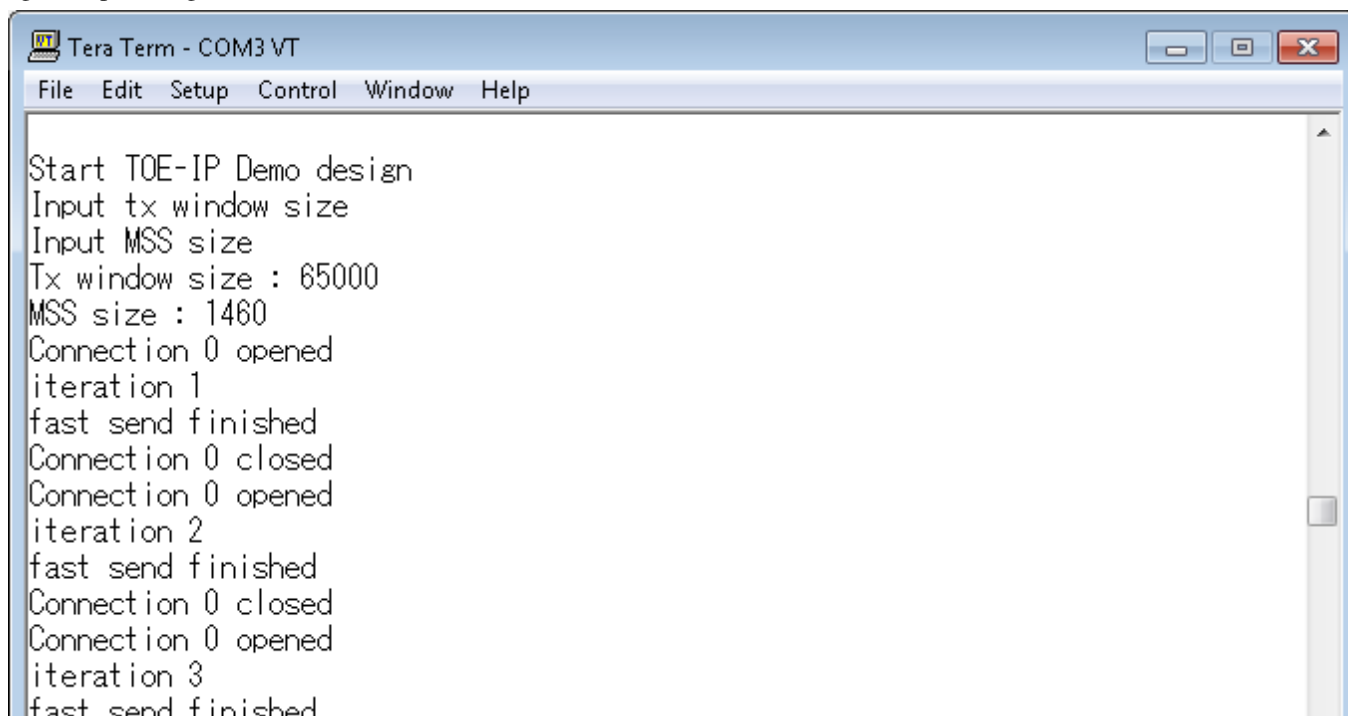


Figure 2: Serial console

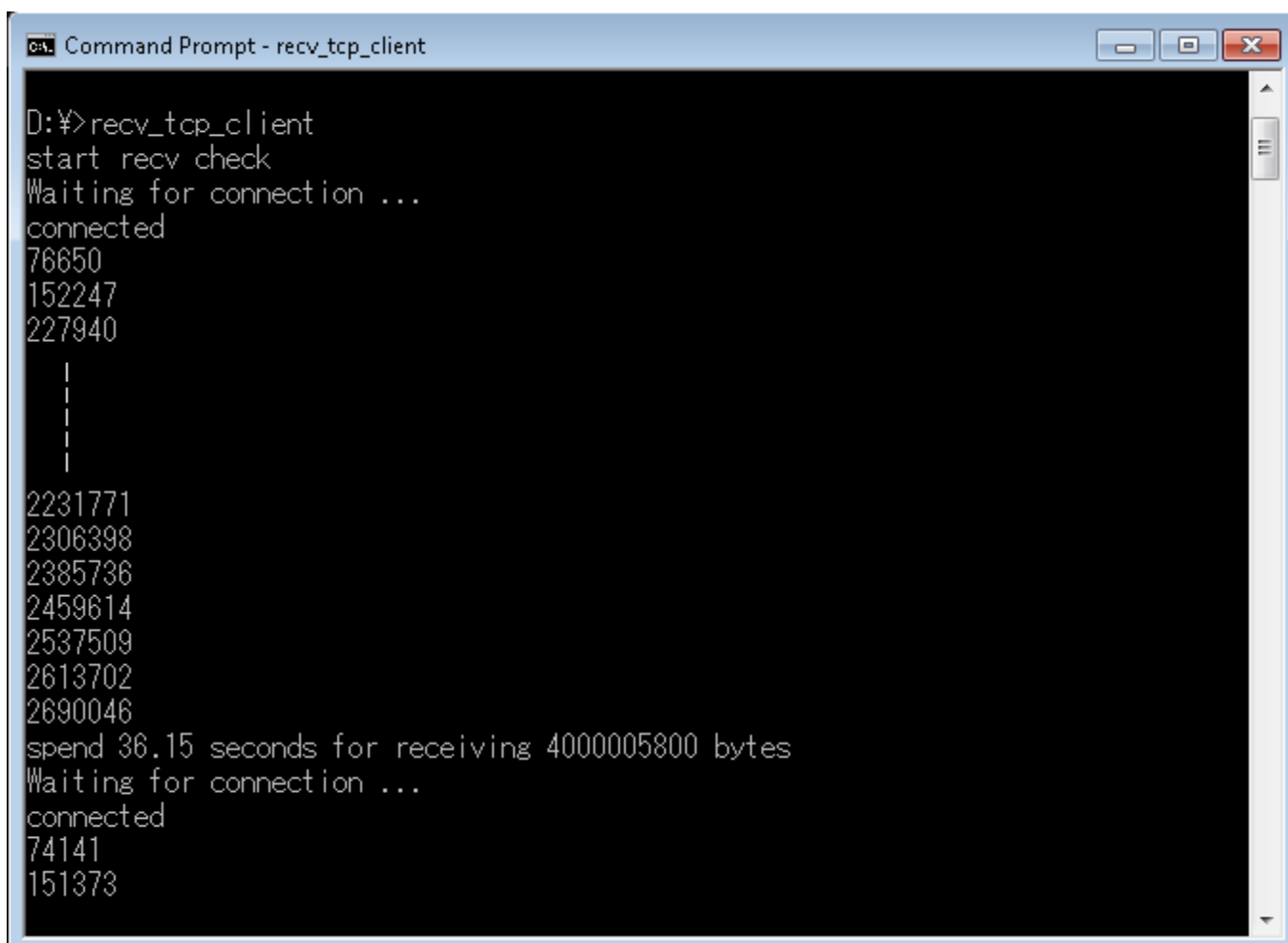


Figure 3: Result of recv_tcp_client.exe

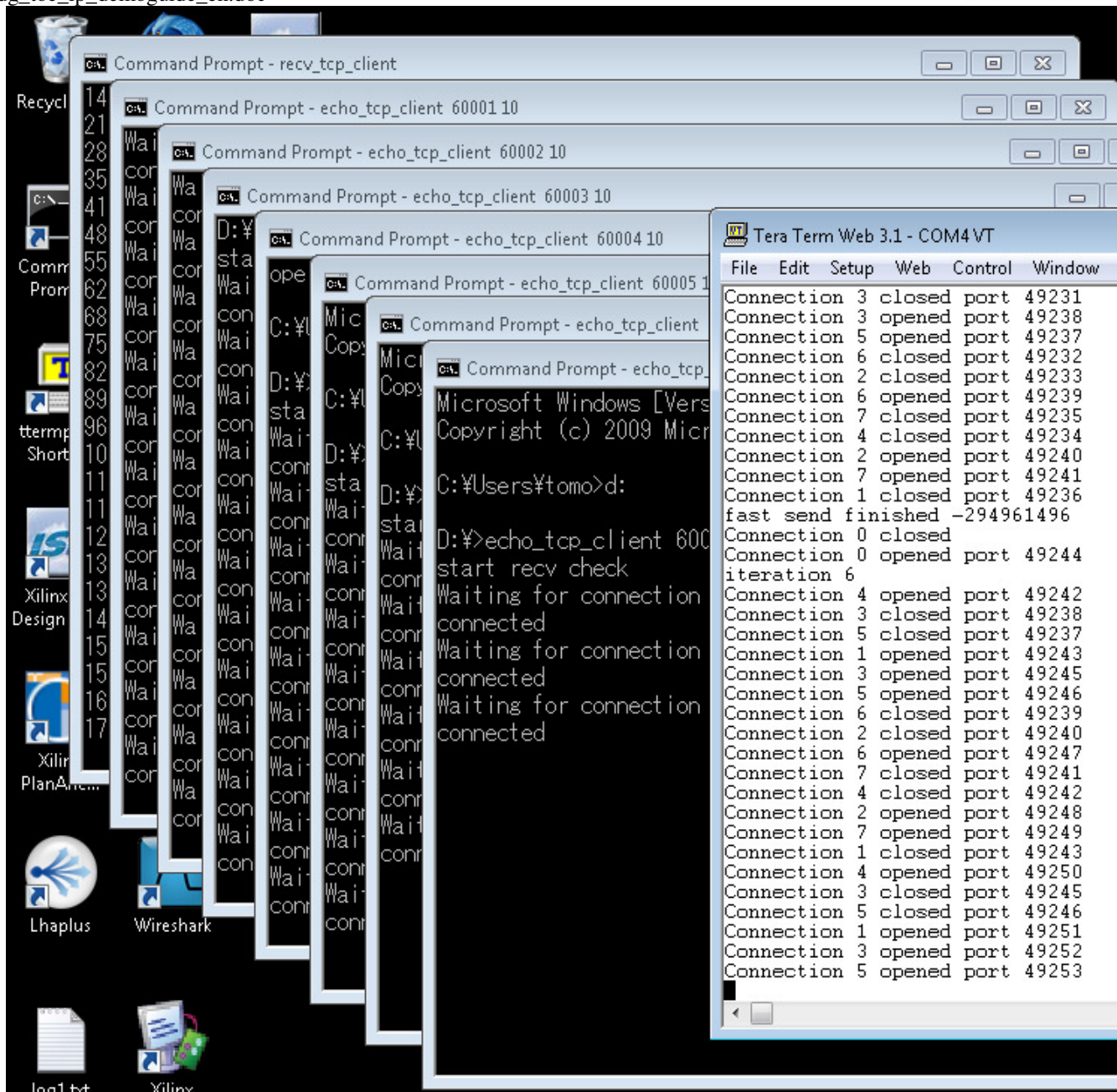


Figure 4: Result of multi-connection

5. Notification

If connection is not opened, it is possible that firewall blocks connection. In this case, set to off firewall of windows or security software.

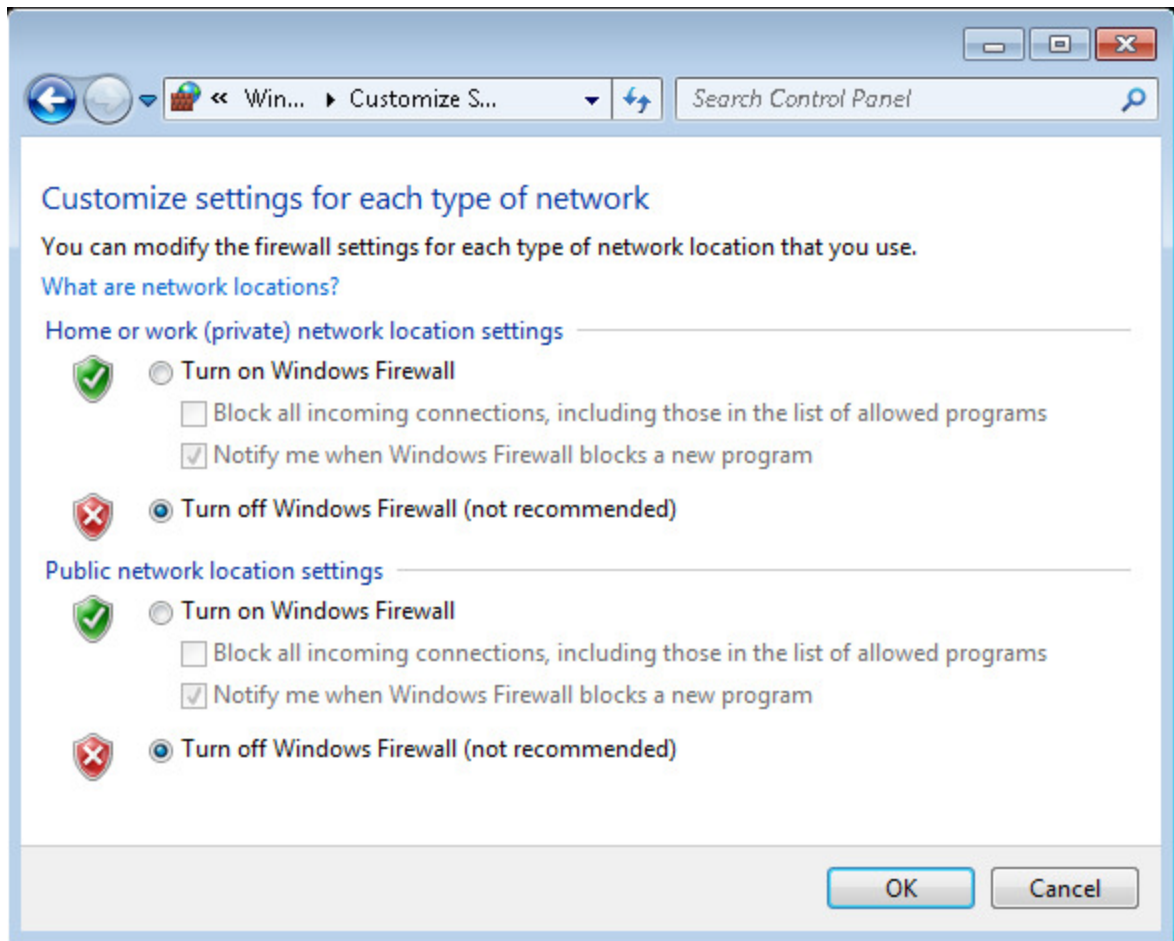


Figure 5: Settings of Windows firewall

If packet scheduler of Windows or packet monitoring program of virus scan software is working, network performance is slow.

If user evaluates data transmission performance, set to off extra function about network. Some of virus-scan software charges load to network even if its function is turned off. In this case, uninstall the software.

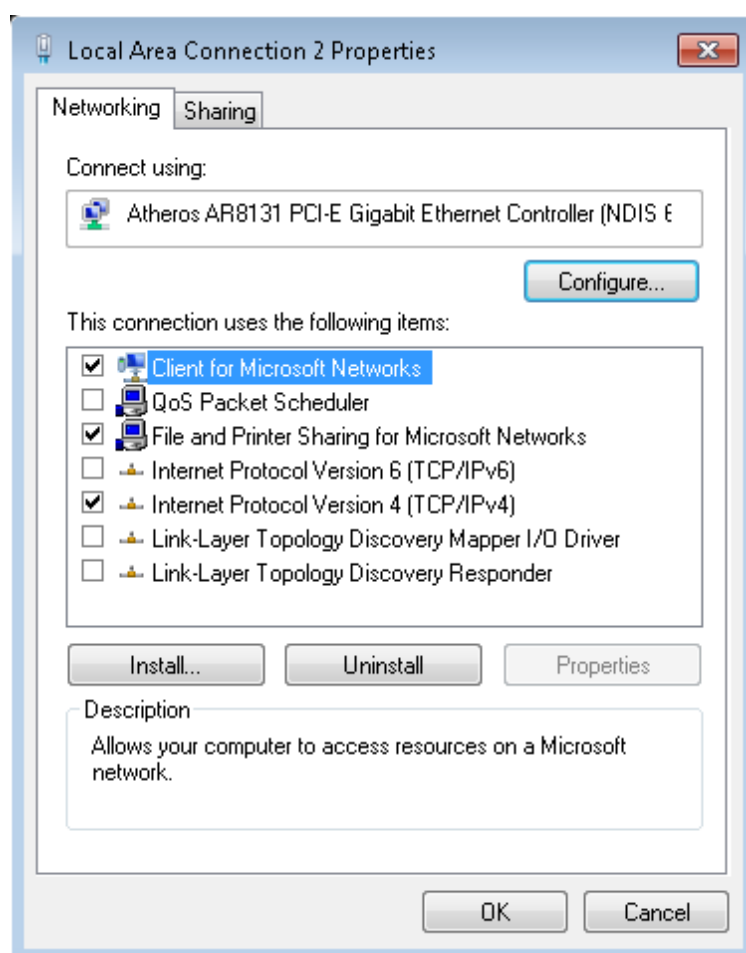


Figure 6: Example of network property settings

If you use Windows XP or Vista for receiver PC, the performance may be bad. So you have to change registry in Windows for reducing return ACK.

Please see below for detail

- New registry entry for controlling the TCP Acknowledgment (ACK) behavior in Windows XP and in Windows Server 2003

<http://support.microsoft.com/kb/328890>

Setting value “10” is good for “MSS=1460”. Usually the performance is good in Windows 7 without this setting.

There is some cases it cannot link up caused by compatibility of PC and Ethernet PHY on FPGA evaluation board. This demo design operates at only 1000Mbps link, so check whether it links up at 1000Mbps. If it links up at 100Mbps or 10Mbps, it is possible to link up at 1000Mbps by setting 1000Mbps in Ethernet Adapter property.

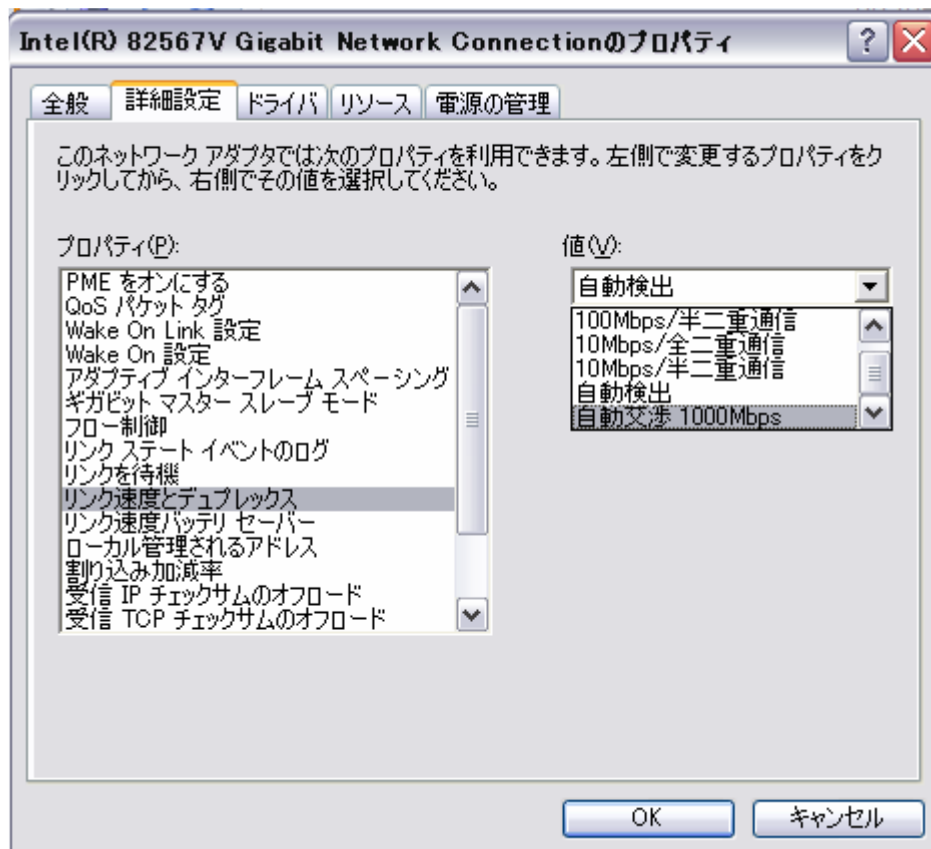


Figure 7: Setting in Ethernet Adapter property

6. Revision history

| リビジョン | 日付 | 内容 |
|-------|------------|----------------------------------------------------|
| 2.1 | 2010/09/08 | English version of dg_toe_demoguide_jp version 2.1 |
| 2.2 | 2010/12/08 | English version of dg_toe_demoguide_jp version 2.2 |
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