

EE3009 Lab 1 - Setting a small LAN and Broadband Router

Lab. Session: _____ Name: _____ CityU ID: _____
Group No.: _____
Date: _____

Part I : Setting a Small Local Area Network

A. Objectives:

- To set up a small Local Area Network LAN.

B. Equipment:

Hardware used in the lab.

- Personal Computer (username : ee3009)
- Hub or Switch
- UTP cables

Software used in the lab. - Windows 7 operation system

C. Procedures:

You are using a 172.16.10.0 network only. So you can have 1-254 hosts in the network. You have to configure the IP address of a PC that is different from the other PCs. Otherwise, the warning of duplicated IP addresses will appear.

Step 1

Connect the PCs to the hub.



Figure 1: The NIC card extender



Figure 2: A 4-port hub. Port 4 is the uplink port

Use a UTP cable to connect the NIC (network interface card) to the hub. There is an extender for the NIC card in front of the computer. If you want to cascade the hubs in order to connect more PCs together, simply press down the uplink button of the hub and connect port 4 to the other hub. An alternative way to achieve the same purpose is to use a crossover UTP cable to connect two hubs together. Note that when a crossover cable is used, the uplink button should be in the normal position.

Step 2

Checking the physical connection



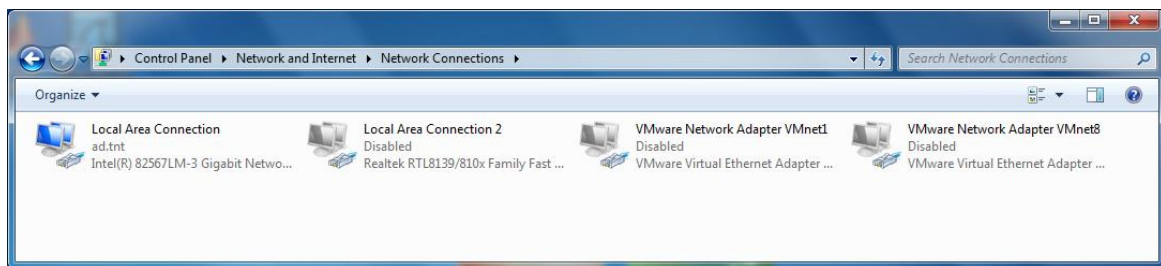
Figure 3: The indicated LED can tell you the status of the physical connections

When you finish the connection, the front panel's LED will be on. Otherwise, you have to check the cables.

Step 3

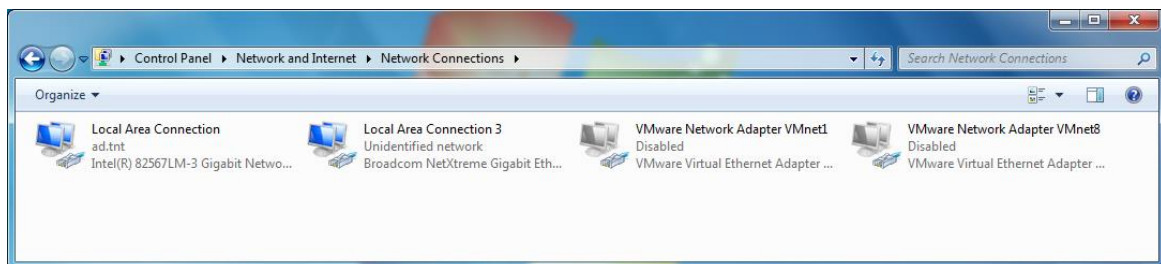
Configure the IP address of a Windows PC.

Open **Control panel** and click **Network and Internet**, then **Network and sharing Center**. Finally, click **Change adapter setting**.



Choose : Realtek RTL8139/810x Family Fasterthernet

or



Choose : Broadcom NetXtreme Gigabit Ethernet

Double click the **Local Area Connection** that you have connected the UTP cable. Select the **Internet Protocol Version 4 (TCP/IPv4) Properties**.

Type in your host's settings:

IP address: **172.16.10.x** (where x is a number between 1 and 254)

Subnet mask: **255.255.255.0**

Default Gateway: not needed in this lab.

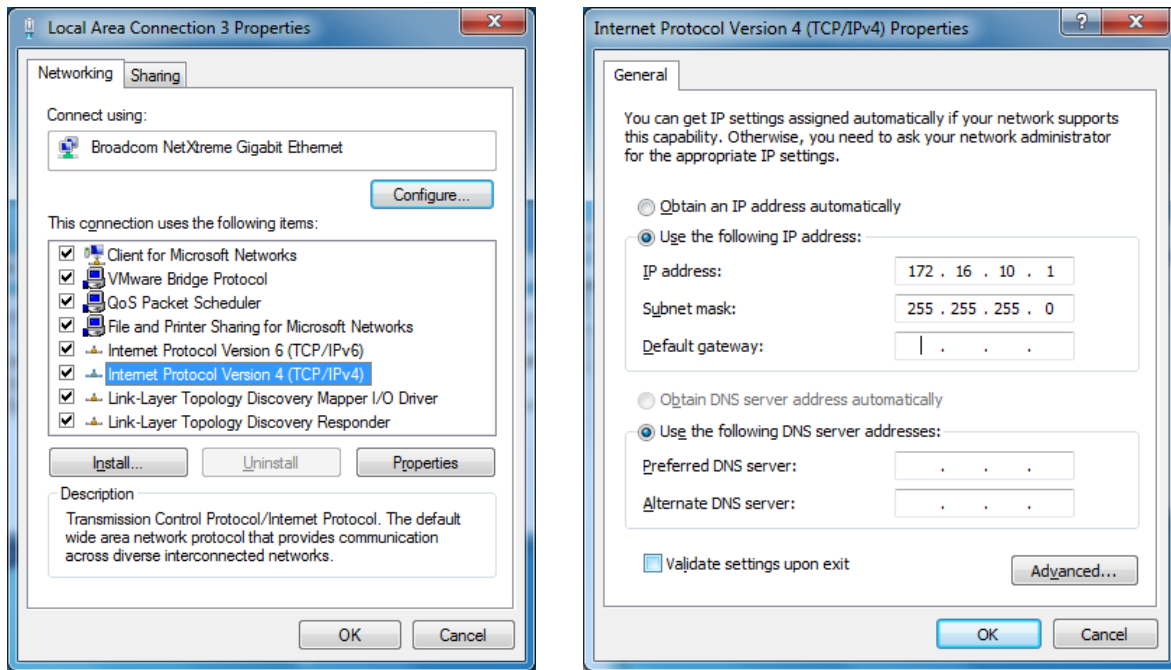


Figure5: Fill in the TCP/IP settings

What is the purpose of the subnetmask?

Step 4

Check the IP settings.

Choose **Start | Run**. Type **cmd** and press **ENTER**.

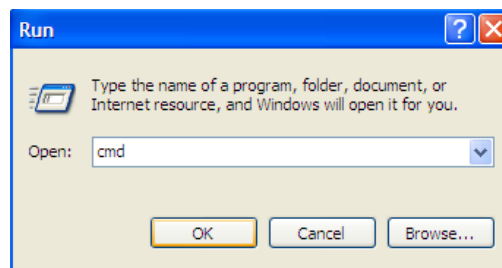


Figure 6: Run the command line screen in Windows environment.

Use **ipconfig** to check IP settings. Type **ipconfig** and press **ENTER**.

```
Administrator: C:\windows\system32\cmd.exe

C:\Users\eeelab>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection 3:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::89ce:79b1:73f7:6d6c%21
    IPv4 Address. . . . . : 172.16.10.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Tunnel adapter isatap.{86335C15-7571-4009-A5CA-4D98B13CDA94}:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Tunnel adapter Local Area Connection* 12:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

C:\Users\eeelab>
```

Figure 7: Use ipconfig to check IP settings

Note that the IP shown should be match with what you enter in **Step 3**.

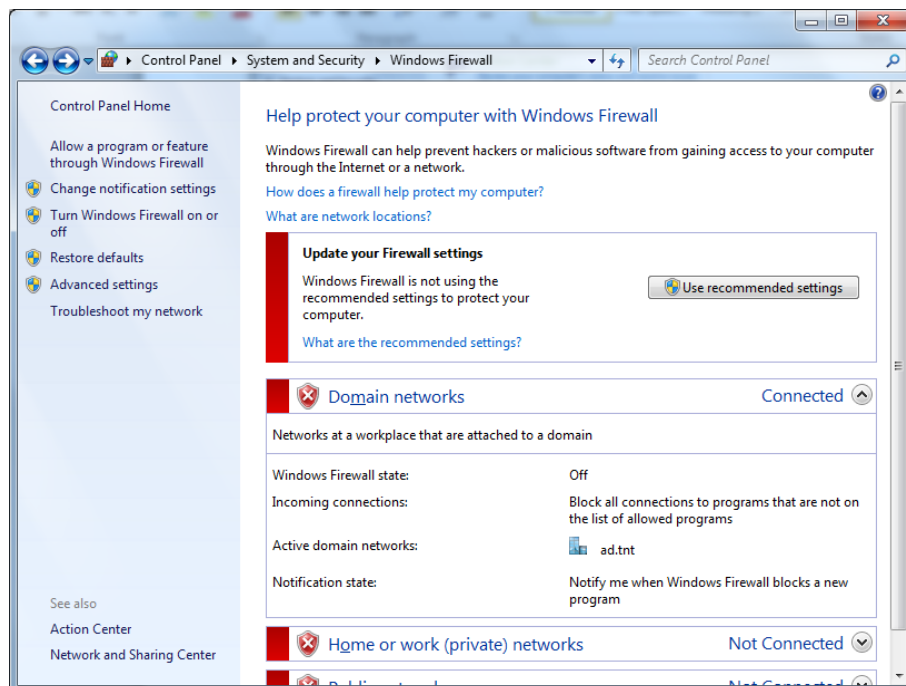
Step 5

Check the network connections

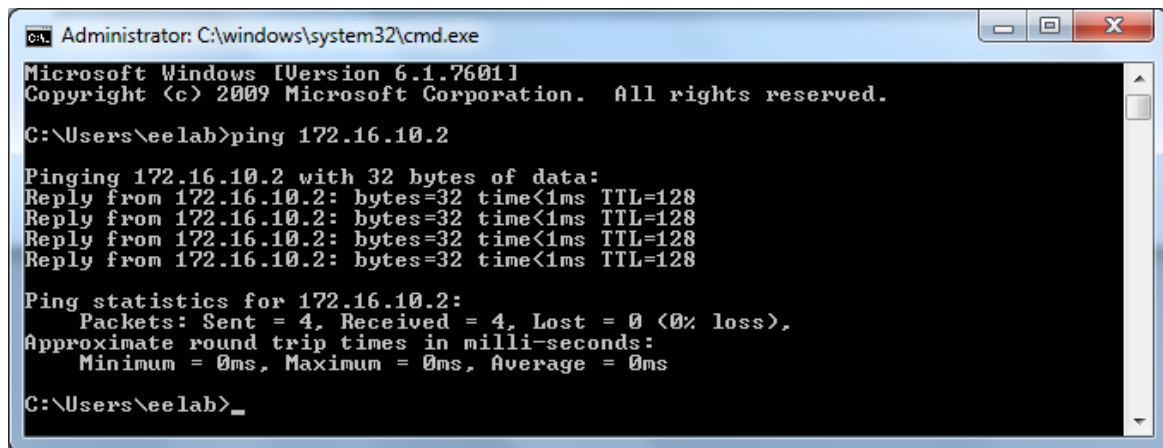
Now repeat step 1 to 4 with a second PC using a different IP (172.16.10.y).

Use **ping** command to check the network connection. Ping command is a very useful command. It will check the connectivity of the network.

Before you use the **ping** command, remember to close the **firewall** of Windows 7.



At one of the connected PCs, click **Start | Run**. Type **cmd** and press **ENTER**.
Type **ping 172.16.10.n** ($n = x$ or y , i.e. IP of the other PC) and press **ENTER**.



```
Administrator: C:\windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\eeelab>ping 172.16.10.2

Pinging 172.16.10.2 with 32 bytes of data:
Reply from 172.16.10.2: bytes=32 time<1ms TTL=128
Reply from 172.16.10.2: bytes=32 time<1ms TTL=128
Reply from 172.16.10.2: bytes=32 time<1ms TTL=128
Reply from 172.16.10.2: bytes=32 time<1ms TTL=128

Ping statistics for 172.16.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\eeelab>_
```

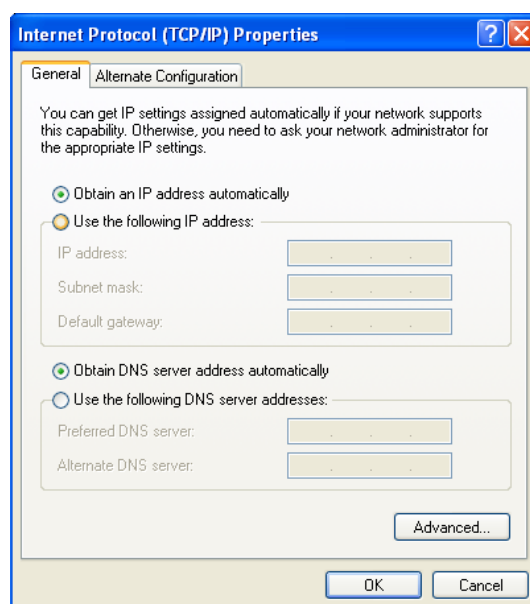
Figure 8: Use ping to check connectivity

Replies from the other PC as shown in the above figure tell you that the network connections between your PC and the other is functioning.

Step 6

DHCP settings

Usually PC network settings are configured automatically with DHCP to facilitate easier management. Open the Network Connections Properties. Remove all your UTP cables. A red cross appear on the **Local Network Connection** that you had configured in the last steps. Select the other **Local Network Connection** that is connecting to the internet. Open its properties to find **Obtain an IP address automatically** and **Obtain DNS server address automatically** are selected.

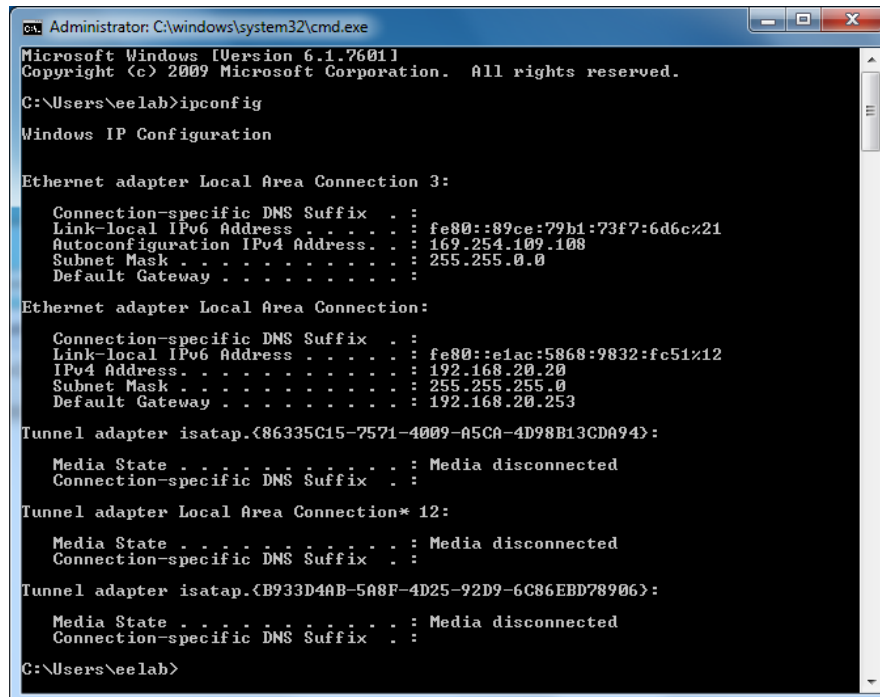


Click **OK** to close the menu. Right click **Local Network Connection** to select **Enable**.
Open a command prompt by typing **cmd** at **RUN** and type

`ipconfig /all`

to check the IP settings.

The following figure show possible output. Data may vary for different settings.



```
Administrator: C:\windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\eeelab>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection 3:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::89ce:79b1:73f7:6d6c%21
    Autoconfiguration IPv4 Address. . : 169.254.109.108
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . : 

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::a1ac:5868:9832:fc51%12
    IPv4 Address. . . . . : 192.168.20.20
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.20.253

Tunnel adapter isatap.{86335C15-7571-4009-A5CA-4D98B13CDA94}:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Tunnel adapter Local Area Connection* 12:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Tunnel adapter isatap.{B933D4AB-5A8F-4D25-92D9-6C86EBD78906}:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

C:\Users\eeelab>
```

Write down information shown on your PC about DHCP

Part II - Broadband router

Objectives:

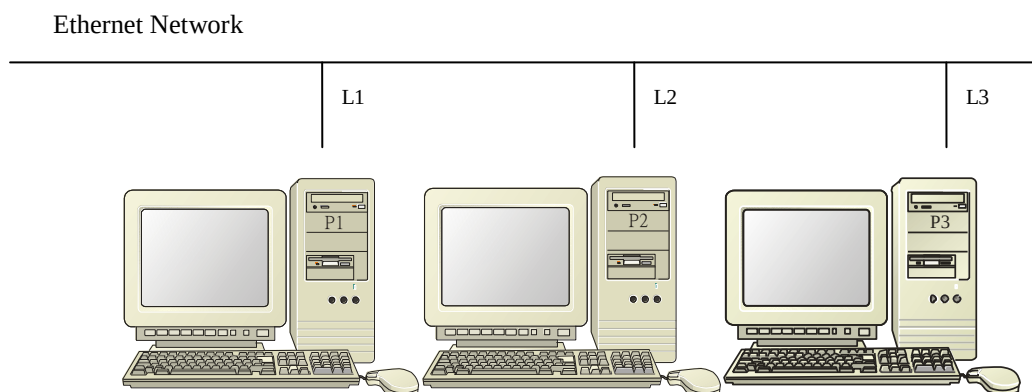
- To familiarize with the function of a broadband router through setting up a small network
- To learn the basics on network management by connecting to the Internet via the broadband router.

Important Note :

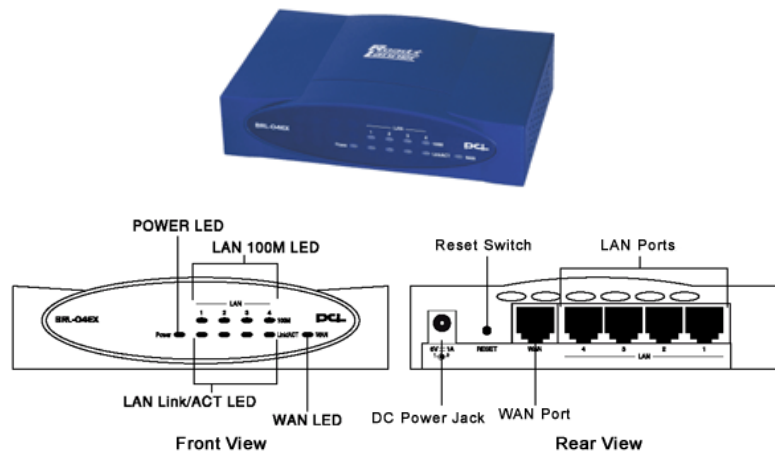
1. Reset the broadband router
After switch on the router, press the reset button for over 10 seconds.
2. Shutdown Window firewall
Beware that the firewall will be auto-enabled when the Network card setup is changed.
3. All PCs have two Network cards
One for connecting to internet. Use this for PC P1 and P2
Another is idle (i.e. the one with extender in front of the PC). Don't use it for this lab

Equipment:

- 3 PCs connecting to the Internet. The OS of the PCs is Microsoft Windows 7.



- 3 UTP patch cords and 1 RJ45 to RJ45 connector.
- 4 ports Broadband Router with Model BRL04-EX and its transformer.



Background Information:

Connecting broadband router allows two or more computers to share an internet connection using network address translation (NAT). With only a single IP address on the Internet, all of the computers in your home can be connected to the Internet at the same time. Additionally, NAT naturally acts as a rudimentary firewall by masking the true IP address of our computer - thus helping to keep your systems safe from hackers.

Procedures:

1. Basic configuration of Broadband Router

Basic configuration include internet connection setting, internal IP addressing, password setting and time zone setting. Internet connection settings usually depends service provided by the internet service provider (ISP). The most common type is **Dynamic IP Address**. Some ISPs require that you register the MAC address of your network card, which was connected to your cable or xDSL modem during installation. Therefore, in order to connect the Router to our cable or xDSL modem in place of the PC, you must change the Router MAC to duplicate (or clone) you network card MAC. In this session, you pretend to have register with the network card MAC of P1 and the ISP use Dynamic IP Addressing. You have a broadband router and would like to connect one more PC to internet. You need to configure the broadband router to suit the purpose and are required to further investigate the operation of a broadband router through the log.

1.1 Check existing settings of internet connection

On each computer, open a command prompt (Click **Start>Run**, type **cmd** and click **OK**). At the command prompt, type **ipconfig /all |more** and press ENTER. Write down the name, IP (Original IP) and physical address of each computer (Note: There may be more than one network adapter. Choose the one that have IP address assigned).

	Computer Name	IP (original IP)	Physical Address
P1			
P2			
P3			

1.2 Open Start> Control Panel > Network and Internet Connections > Network Connections

For every network connections, right click to select **Properties**, click **Show icon in notification area when connected**. And, open properties of **Internet Protocol (TCP/IP)** and make sure **Obtain an IP address automatically** is selected. Select the page **Advanced**, click **Settings** and then **Off** to turn off the Windows Firewall

1.3 Refer to Fig.1. Disconnect P1 from Ethernet Network. Connect a RJ45 to RJ45 adapter to the link L1 and connect another patch cord (L4) to the other end of the RJ45 adapter. Connect the other end of last patch cord (L4) to the WAN port of the broadband router. Connect P1 to a LAN port of the broadband router with a patch cord (L5). Also, Disconnect P2 from the Ethernet Network and connect the same socket to a LAN port of the broadband router with another patch cord (L6).

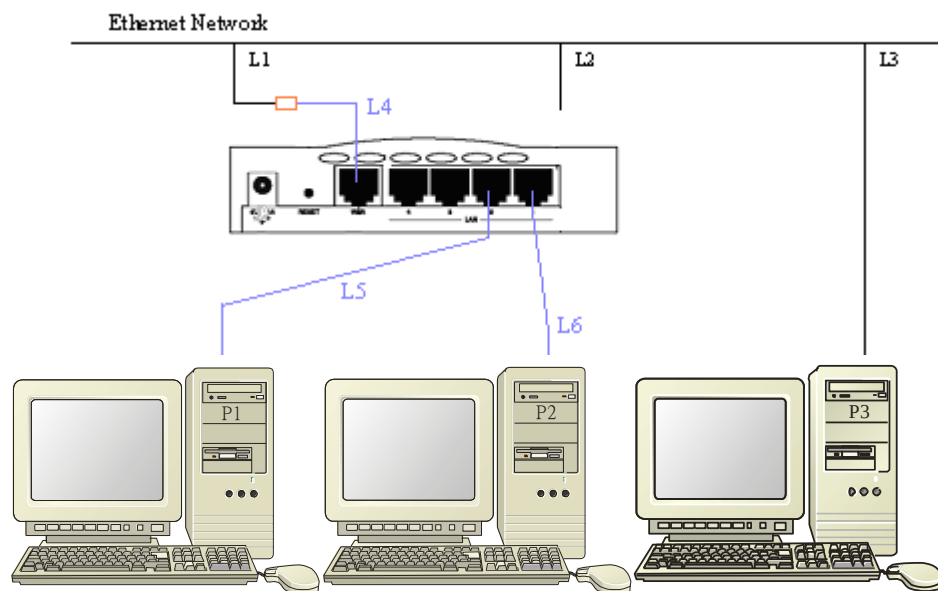


Fig.1

1.4 Connect the transformer output to the broadband router.

1.5 Noticed the Network Connection icon appear to be connected on taskbar of P1 and P2 correspondingly.

1.6 What is the connecting speed indicated when the icon appears?

1.7 On **P1**, click **Internet Explorer**, type on the **Address**

<http://192.168.1.1>

Enter **0000** as the password and login.

1.8 On **P1**, open the broadband router setup page, click **MAIN MENU : TOOLS**. Click **RESTORE FACTORY DEFAULT**. Click **RESTORE** and then **OK** to start. Notice that the network connection icon shows disconnected and wait until it shows connected again.

1.9 On **P1** and **P2**, open **Internet Explorer** and find that the default web page cannot be found. Open a **Command Prompt**. Type **ipconfig /all**. What are the IP addresses for **P1** and **P2** now?

	IP
P1	
P2	

1.10 Does the IP differ from that obtained in procedure 1.1? Why?

1.11 On **P1**, click **Internet Explorer**, type the following URL on the **Address** field.

<http://192.168.1.1>

Enter **0000** as the password and login.

1.12 Click **STATUS**, record the following information of the broadband router

Current Time	_____
WAN Cable/DSL	_____
LAN IP	_____
INFORMATION:	
Runtime Code Version	_____

1.13 Click **SETUP > BASIC SETTING : WAN**. Click **Dynamic IP Address**. Click **NEXT** to continue.

1.14 At **Host Name**, type computer name of **P1**. Write down the MAC address shown.

1.15 Click **Clone**.

1.16 What happened to the MAC Address? _____

1.17 Click **Enter** and on the **LAN SETTING** screen, click **ENTER** to save settings. Notice that the network connection icon would show disconnecting and connecting again.

1.18 Click Enter on the screen to save settings. Notice that the network connection icon would show disconnecting and connecting again.

1.19 Click **STATUS**. Write down the following information shown on the screen.

WAN Cable/DSL _____
WAN IP _____
Subnet Mask _____
Gateway _____
Primary DNS _____

1.20 Notice that the **WAN MAC** address under **INFORMATION** changed. Study the security log and find out the IP address of the DHCP Server on the network of the TNT intranet.

IP Address of DHCP Server _____

1.21 Write down the log statements that show the DHCP protocol.

1.22 For **P1** and **P2**, open **Internet Explorer** again, can you connect to the internet from both PCs?

**** Check point 1**

2 IP Address Reservation

When you have PCs with different security settings, IP address reservation is used to let particular PC always use same IP address so that filters can be set to affect particular PC instead of all. In this session, **P2** is assumed to be a server that you would like to pay particular attention to. You will reserve a particular IP address for **P2** so that in later sessions, some security settings can be applied to it.

2.1 On **P1**, open the broadband router setup page, click **SETUP > BASIC SETTING : LAN**. Add item 1, **192.168.1.200** with the physical address of **P2** (as written down in step 1.1). Click **Enabled** and **ENTER** on the screen to save settings.

2.2 Wait until WAN is connected again. On **P2**, at Command Prompt, type
> **ipconfig /release**
> **ipconfig /renew**

2.3 What is the IP assigned?

2.4 Start **Internet Explorer**, type **http://www.ee.cityu.edu.hk**. Can **P2** connect to the EE home page?

3 Network Address Translation (NAT)

3.1 On **P1**, open the broadband router setup page, click **SETUP > ADVANCED SETTING : NAT**. Click **Disable**. Click **ENTER** to save settings

3.2 On **P1** and **P2** open the **Internet Explorer** and enter address
<http://www.cityu.edu.hk>.

Can you connect to the home page of City University of Hong Kong? Why?

3.3 At a **Command Prompt** of **P1** and **P2**, type
> **ipconfig /all**

Does the broadband router assign IP to **P1**, **P2**?

3.4 At a **Command Prompt** of **P1**, type

➤ **ping** 192.168.1.200

Does **P1** receive response from **P2**?

4 NAT - Address Mapping

4.1 On **P3**, open a **Command Prompt**, type

> **ping** *original ip of P2*

4.2 Is there any response ? Why?

4.3 On **P1**, open the broadband router setup page, click **SETUP > ADVANCED SETTING : NAT**. Click **Enable**. Click **ENTER** to save settings.

4.4 Click **ADDRESS MAPPING** on main menu, enter original IP of **P2** into the Global IP and IP address range from 192.168.1.200 to 192.168.1.200. Click **ENTER** at the end of the page to save settings.

4.5 On **P3**, open a **Command Prompt**, type

> **ping** *original ip of P2*

4.6 Is there any response? Who is responding?

4.7 On **P3**, open the **Explorer** and create a directory SHARE in C:\. Right click SHARE and click **Sharing**. On the dialog box, click **Share this folder** and click **OK**.

4.8 On **P2**, on **RUN**, type **\\ip of P3\share**.

4.9 On **P3**, open a **Command Prompt** and type

>**netstat -a**

From the result, find out which line indicate the sharing connection. Write down in the following space. And what is the IP address of **P2** indicated on **P3**?

4.10 Repeat **4.8** on **P1**. Use **netstat -a** again to find out IP address of **P1** as known by **P3**.
Write down this IP address

4.11 Click **ADDRESS MAPPING** on main menu, remove the settings you have entered on procedure **4.4**. Click **ENTER** at the end of the page to save settings.

5 NAT – Virtual Server

5.1 On **P1**, open the broadband router setup page, click **SETUP > ADVANCED SETTING : NAT > VIRTUAL SERVER**

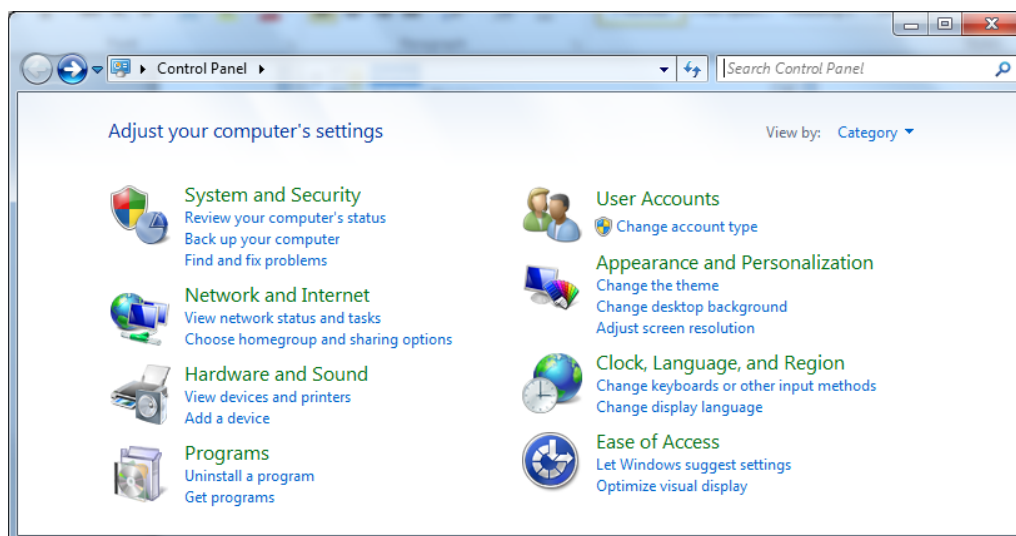
5.2 Enter the following

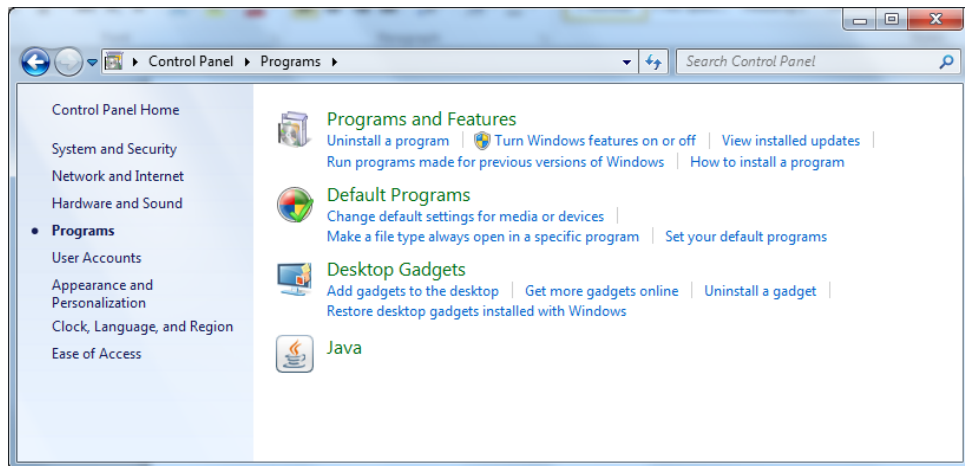
Private IP	Private Port	Type	Public Port
192.168.1.200	80	TCP	8080
192.168.1.200	21	TCP	21

Click **ENTER** at the end of the page to save settings.

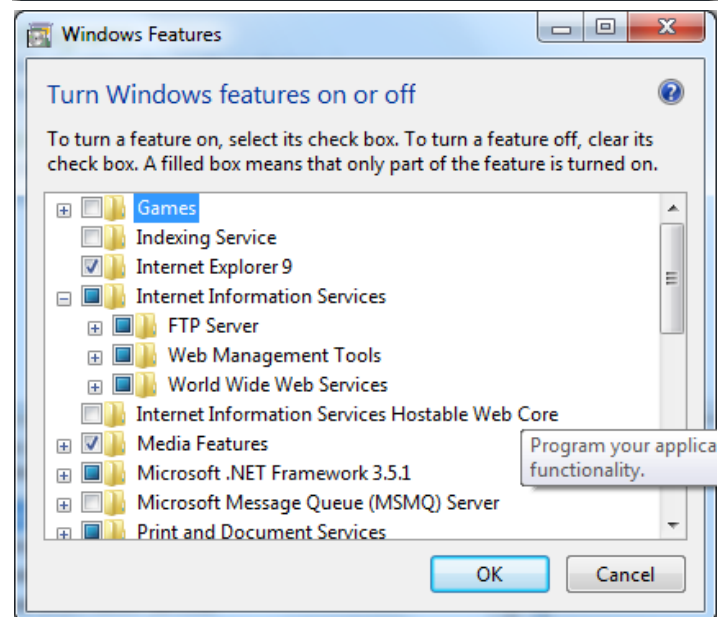
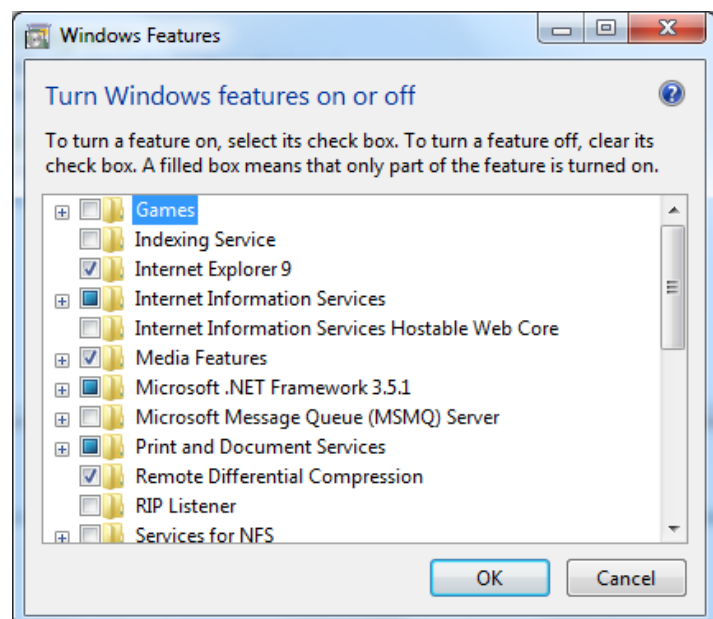
5.3 Install **Internet Information Services (IIS)** :

Choose **Control Panel > Programs > Turn Windows feature On and Off**





Select all the check box under Internet Information Services.



5.4 On **P1** and **P2**, open **Control Panel** and **Administrative Tools**. Then open the **Internet Service Services**. Click the name of the corresponding workstation and right click **Default FTP Site** and click **start**. Right click **Default Web Site** and click **start**.

5.5 On **P2**, open **Explorer** and open directory c:\Inetpub\ftproot. Create a new text file and rename it **Welcome_to_P2**.

5.6 On **P3**, open a **Command Prompt** and type

> **ftp original ip of P1**

Login as **anonymous** and type

> **ls**

Check that the file 'Welcome_to_P2' appear in the list.

5.7 On **P1** and **P2** create a web page c:\Inetpub\wwwroot\default.htm with *computer name* of the corresponding workstation on it.

Note: If you do not familiar with writing web page, open Microsoft Word, type *computer name* and at the File Menu, select **Save as Web Page....**

5.8 On **P3**, open **Internet Explorer** and type

http://original ip of P1:8080

Which web server you are connecting to **P1**? **P2**? Broadband Router?

6 FIREWALL – Access Control : IP Address / Protocol / Time Zone

6.1 On **P2**, open **Internet Explorer**, type <http://www.ee.cityu.edu.hk>

6.2 Can you connect to the home page of Department of Electronic Engineering?

6.3 Now, type <http://proj.cityu.edu.hk>

6.4 Can you connect to the above EE server?

6.5 On **P2**, open a **Command Prompt**, type
> **telnet eda.ee.cityu.edu.hk**

6.6 Can you get the login prompt?

6.7 Press **Ctrl-]** and **quit** to end the telnet session.

6.8 On **P2**, open a **Command Prompt**, type
> **ping eda.ee.cityu.edu.hk**

6.9 Does eda.ee.cityu.edu.hk response to your ping?

6.10 On **P1**, open the broadband router setup page, click **SETUP > ADVANCED SETTING : FIREWALL**. Click **Enable** to enable firewall module function. Click **ENTER** to save settings.

6.11 Click **FIREWALL : Access Control**. On the item **Enable Filtering Function**, click **Yes**.

6.12 Under the **Normal Filtering Table**, click **Add PC** and enter the following

Client PC Description : Group_A

Client PC IP Address : 192.168.1.200 ~ 200

6.13 Under the session **Client PC Service**, find **TCP** and click on the square at the end of the row to block all TCP ports.

6.14 Click **OK** at the end of the page. After returning to the previous page, notice that the **Group_A** entry appear in the Normal Filtering Table. Click **ENTER** at the end of the page to save settings.

6.15 On **P2**, open a **Command Prompt**, type
> **telnet eda.ee.cityu.edu.hk**

6.16 Can you make telnet session with eda.ee.cityu.edu.hk?

6.17 On **P2**, open a **Command Prompt**, type
>**ping eda.ee.cityu.edu.hk**

6.18 Does eda.ee.cityu.edu.hk response to your **ping**? Why?

6.19 On **P2**, open Internet Explorer, type
http://current ip of P1

6.20 Can you connect to **P1**? Why?

6.21 On **P1**, open the broadband router setup page, click **SETUP > ADVANCED SETTING : FIREWALL > Access Control**. In the **Normal Filtering Table**, click **Edit** to edit the entry of **Group_A**. Uncheck **TCP Blocking** and check **WWW with URL Blocking**. Click **OK** and then click **ENTER** to save settings.

6.22 Click **URL Blocking** on the main menu. Enter **www.ee.cityu.edu.hk** on Site 1 and enter **proj** on Site 2. Click **ENTER** at the end of the page to save settings.

6.23 Repeat 6.1 and 6.3. Can you connect to the home pages? Why?

6.24 How do you know that you are only blocked from accessing these web pages?

**** Check point 2**

7. Clean up and conclusion

Reset the broadband router to factory defaults by pressing the **RESET** switch for 30 seconds. Clean up and return the equipment to lab counter.