Project • Community Network Planning

Project Requirement:
Building a community network connecting 16 apartment buildings with total of 741 units. Each unit will have access to 2 ports, totaling 1482 ports. The purpose of this network is to let the residents share Internet connections (4 to 24 ADSL lines); establishing a community bulletin board, a web/email server, and a multi-media server.

Community Environment:
In this community, there are total of 16 apartment buildings with 742 units. Each unit will be allocated 2 Fast Ethernet ports. Below is the summary of the building complexes:

<table>
<thead>
<tr>
<th>Building No.</th>
<th>Stories</th>
<th>Number of Units per building</th>
<th>Total Ports per building</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>54</td>
<td>108</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>54</td>
<td>108</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>54</td>
<td>108</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>54</td>
<td>108</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>54</td>
<td>108</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>36</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>11</td>
<td>7</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>13</td>
<td>7</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
<td>54</td>
<td>108</td>
</tr>
<tr>
<td>15</td>
<td>7</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>16</td>
<td>7</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>741</td>
<td>1482</td>
</tr>
</tbody>
</table>
## Equipment Used:  (The quantity needed will be calculated later)

<table>
<thead>
<tr>
<th>Model number</th>
<th>Picture</th>
<th>Product Feature</th>
<th>Quantity</th>
</tr>
</thead>
</table>
| Ether-FSH24G Gigabit Ethernet Switch | ![Picture](#) | • 24-port 10/100BaseTX  
• 2 Gigabit Modules  
• 9.6 Gbps Throughput  
• 12 MB Memory Buffer  
• 16K MAC Address Table  
• 432 ×237 ×44 mm  
• 19-inch Rack Mountable  
• Designed for medium to large network | 1 |
| Ether-FSH1602G Gigabit Ethernet Switch | ![Picture](#) | • 16-port 10/100BaseTX  
• 2 Gigabit Ports  
• 8 VLAN Groups  
• Trunking  
• 9.6 Gbps Throughput  
• 12 MB Memory Buffer  
• 16K MAC Address Table  
• 432 ×208 ×44mm  
• 19 inch Rack-Mountable | 1 |
| Ether-FSH24RS Fast Ethernet Switch | ![Picture](#) | • 24-port 10/100BaseTX  
• Support 4-port Trunking  
• 4 VLAN Groups  
• 4.8Gbps Throughput  
• 512k Memory Buffer  
• 2K MAC Address Table  
• 432 × 193 × 44mm  
• 19 inch Rack-Mountable | 62 |
| Ether-FSH16D Fast Ethernet Switch | ![Picture](#) | • 16-port 10/100BaseTX  
• 5.3 Gbps Throughput  
• 2MB Memory Buffer  
• 16K MAC Address Table  
• 332 x 142 x 44mm  
• 19 inch Rack-Mountable. | 12 |
| OV-IP 2040 XDSL/CableModem Router | ![Picture](#) | • Support ADSL/Cable Modem  
• 253 DHCP auto-configure clients  
• More than 65,000 manually configure IPs.  
• Built-in 4-port 10/100 Switch | 4 to 16 |
| OV-110TMC Transceiver | ![Picture](#) | • 10/100BaseTX to 100BaseFX, SC Connectors  
• Up to 2KM using multimode fiber. | 32 |
ADSL Sharing

OV-IP2040 ADSL is equipped with 4 10/100Mbps ports. It can auto-configure up to 253 DHCP clients. It allows over 65,000 IP addresses through manual configuration. DHCP service enables auto-configuration of IP and Gateway for the stations. It is necessary for community network because the IP assignment must be dynamic. Because each OV-IP2040 can only manage up to 253 DHCP clients. We need at least 6 routers for the community total of 1482 ports. OV-IP2040’s default DHCP clients is 128, but the value can be adjusted between 0 and 253.

ADSL Sharing Methods for this project:

1. **DHCP Service provided by ADSL Routers** (minimum of 6 OV-IP2040)

   ![Diagram of ADSL Routers](image)

   **Requirements:**
   
   I. Minimum of 6 OV-IP2040
   
   II. Each router’s IP address must be set different. I.E. the first router is 192.168.1.24, the second is 192.168.2.254, …. Etc).
   
   III. Each router’s DHCP configurable IP range must be set different. I.E. the first router is 192.168.1.1 to 192.168.1.253. The second router is 192.168.2.1 to 192.168.2.253, …etc).

   **Principle:**

   From the above diagram, we are connecting all the ADSL routers to a single switch. Each router’s IP address and DHCP client IP range are set differently. When a resident connect a computer to the community network. The subsequent DHCP negotiation will occur:
I. The resident’s computer will send out a DHCP request to all routers asking for automatic IP configuration.

II. All routers that receive this request will send out DHCP invitations to the computer.

III. The computer will accept the first invitation and reject all subsequent offers from other routers.

IV. The router that received the acceptance will assign the computer an IP address and gateway. From this point on, this computer will connect to internet through this router with the assigned IP address.

When a router’s DHCP clients reach the maximum allowable figure (between 0 and 253), it will no longer response to DHCP request. The request will be handled by the next available router. Because each DHCP request is handled by a randomly chosen router, load balancing is achieved.

The biggest advantage to this method is the bandwidth expandability. When the community needs more bandwidth, they can simply add more ADSL routers and connections to the switch. Then each router’s DHCP clients can be reduced, resulting in more bandwidth per client. For example, if we increase the ADSL connections to 16. Each router’s share of DHCP clients is only 93 (1482 ports divided by 16 routers). Thus, we can change each router’s DHCP client IP range to 93.

2. **Setting up a dedicated DHCP server**: If the community wants to share less than 6 ADSL connections, then a dedicated DHCP server must be setup.

   **Clients**

   ![Diagram of network setup]

   **DHCP Server**

   **Requirements:**

   I. An dedicated hardware-based or software-based DHCP server must be setup.
II. Each router’s IP address must be set different. I.E. the first router is 192.168.1.24, the second is 192.168.2.254, …. Etc).

III. Each router’s DHCP service must be turned off.

**Principle:**

DHCP Server can be either a dedicated hardware device or software running on a computer. Windows NT server, Windows 2000 Server and Unix all have built-in DHCP server software. An dedicated DHCP server allows greater number of automatic IP configuration, and a single dedicated DHCP server should be able to serve the entire community. A dedicated DHCP server can assign IP address to a client, then assign the Gateway for which the computer can obtain Internet access. Since each router is assigned as a Gateway, the DHCP server can control which IP range can have access to which router. Load balancing is thus achieved. Like the first method, the bandwidth is expandable. But the IP range and Gateway assignment must be changed whenever new connections are added to achieve optimal load balancing.

3. **Use VLAN to segregate each router’s broadcast domain**

![Diagram of network configuration]

**Requirements:**

I. Require minimum of 8 ADSL routers.

II. VLAN must be setup to separate the broadcast domain.

III. Each router’s IP address must be set different. I.E. the first router is 192.168.1.24, the second is 192.168.2.254, …. Etc).
Principle:

Each OV-IP2040 is equipped with a 4-port switch. We can link each ADSL router to connections from 2 buildings. Then connect all the ADSL Routers to a Ether-FSH1602G as shown in the diagram above. Ether-FSH1602G is capable of supporting up to 8 VLAN groups. Since every two buildings would share an ADSL connection, we need total of 8 routers. Each router’s broadcast domain will be confined to a VLAN group. Each VLAN group will contain an ADSL router and the community server(port 17). For example, VLAN 1 would contain Port 1 and Port 17, VLAN2 would contain Port 2 and Port 17, … etc. Thus, every building would have access to the community server while not be able to see each other. Therefore, each router’s DHCP client are confined. Load balancing is thus achieved.

The community’s server’s IP address and gateway must be set manually to have access to Internet. Using this method, the bandwidth expandability is confined to 8 or 16 ADSL connections.

Bandwidth Requirement:

The designer must be aware of the available bandwidth and cost of Internet connections in the respected market. Then employ the most cost effective solution. Below is the bandwidth suggestion for Internet Café and residential network:

<table>
<thead>
<tr>
<th>Connection</th>
<th>Speed(Down Stream/Up Stream)</th>
<th>Number of Stations</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Internet Cafe</td>
<td>Residential</td>
<td></td>
</tr>
<tr>
<td>T1 Leased 1.54 M</td>
<td>1540K/1540K</td>
<td>100 or more</td>
<td>200 or more</td>
<td></td>
</tr>
<tr>
<td>Leased 512K</td>
<td>512K / 512K</td>
<td>30~ 50</td>
<td>50-80</td>
<td></td>
</tr>
<tr>
<td>Leased 256K</td>
<td>256K / 256K</td>
<td>20~ 30</td>
<td>30-50</td>
<td></td>
</tr>
<tr>
<td>Leased 128K</td>
<td>128K / 128K</td>
<td>15 ~ 20</td>
<td>20-35</td>
<td></td>
</tr>
<tr>
<td>ADSL 1544K</td>
<td>1544K / 384K</td>
<td>20 ~ 30</td>
<td>40-60</td>
<td></td>
</tr>
<tr>
<td>ADSL 768K</td>
<td>768K / 128K</td>
<td>15 ~ 20</td>
<td>30-40</td>
<td></td>
</tr>
<tr>
<td>ADSL 512K</td>
<td>512K / 64K</td>
<td>10</td>
<td>15-20</td>
<td></td>
</tr>
</tbody>
</table>

Note: ADSL speed shows the peak performance while leased line is shown the guaranteed rate.
Project Network Design:

1. As shown in the diagram above, each building has a network equipment room. And the entire community has one Central Equipment Room. The connection between the central equipment room and the buildings are done through multi-mode fiber. Since each building needs two 100BaseTX-to-100BaseFX transceiver, we need total of 32 transceivers for this project. 100Base-FX allow link distance of up to 2 km using 62.5/125um multi-mode fiber and is immune to electronic interferences.

2. On the building side, the tallest building is 12 storey which is about 40 meters from the ground. Therefore, the network radius is still well within the 100m limit of 100Base-TX. With this analysis, we can concentrate all the equipments in one equipment room without having to distribute the switch on every floor. Making service and maintenance easier.

3. Because we can concentrate all the switch equipments in one location, it’s better to use switches with large port count.

4. Using backbone structure to reduce the number of layer of switches.

5. Concentrate all connections from the buildings to one backbone switch in the central equipment room.
6. Ether-FSH1602G is equipped with 9.6Gbps throughput, 12 MB RAM, and 16K MAC address table. It is suitable to be a backbone switch for this project.

7. Network designer should use VLAN to separate the broadcast domain for each building, resulting in better security and performance.

8. Ether-FSH1602G has two RJ-45 Gigabit ports. One port can be used to connect to a server while another would be used to connect to an Ether-FSH24G switch.

9. Connect all ADSL routers to the Ether-FSH24G switch. The one remaining Gigabit port can be used for server connection.

10. We would use the aforementioned DHCP Service provided by ADSL Routers or Setting up a dedicated DHCP server method to manage the ADSL sharing.

**Building’s Network Layout:**

On the building side, we are going to use the 24-port Ether-FSH24RS and the 16-port Ether-FSH16D switches to connect the lines from each apartment unit. The total number of ports in each building dictates the number and type of switches needed. Thus, we should draw the layout according to the number of ports in each building.

From the Community Environment table, we can see that Building No. 1, 2, 3, 4, 5, and 14 each has 54 units totaling 108 ports. Building No. 6, 8, 9, and 10 each have 48 units totaling 96 ports. Building 13 and 15 each have 42 units totaling 84 ports. Building No. 7 has 36 units totaling 72 ports. Building No. 11, 12, and 16 each have 35 units totaling 70 ports. In this project, we will plan the network layout according to the total number of ports in each building.

To find out the number of switches needed, we must first calculate the number of ports needed. Because uplinking switches will use some of the ports, the number of ports needed is always greater than the total number of ports in each building. The formula to calculate the number of ports needed is:

\[
\text{Ports Needed} = \text{Total Ports in The Building} + 2 \times (\text{number of switch} - 1)
\]

In this project, we must reserve one port for connection from the building to the central equipment room. Therefore, we must add one to the formula:

\[
\text{Ports Needed} = \text{Total Ports in The Building} + 2 \times (\text{number of switch} - 1) + 1
\]

After finding out the number of ports needed, we can proceed to calculate the number
and type of switch needed:

\[
\text{Available Ports} = 24 \times \text{Number of Ether-FSH24RS} + 16 \times \text{Number of Ether-FSH16D}
\]

**Free Ports** = **Available Ports** – **Ports Needed**

If the Free Ports is greater than 8, we can use one Ether-FSH16D to substitute an Ether-FSH24RS

### Model Used

<table>
<thead>
<tr>
<th>Model Used</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ether-FSH24RS Fast Ethernet Switch</td>
<td>24-port 10/100BaseTX, Support 4-port Trunking, 4 VLAN Groups, 4.8Gbps Throughput, 512k Memory Buffer, 2K MAC Address Table, 432 × 193 × 44mm, 19 inch Rack-Mountable.</td>
</tr>
<tr>
<td>Ether-FSH16D Fast Ethernet Switch</td>
<td>16-port 10/100BaseTX, 5.3 Gbps Throughput, 2MB Memory Buffer, 16K MAC Address Table, 332 × 142 × 44mm, 19 inch Rack-Mountable.</td>
</tr>
</tbody>
</table>
Use the formulas above, we can get the following results in table:

<table>
<thead>
<tr>
<th>Building No.</th>
<th>Ports per Building (2 ports per unit)</th>
<th>Switch needed</th>
<th>Ports Needed</th>
<th>Number and Type of Switch needed</th>
<th>Free Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ether-FSH24</td>
<td>Ether-FSH16 RS D</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>108</td>
<td>5</td>
<td>117</td>
<td>5 0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>108</td>
<td>5</td>
<td>117</td>
<td>5 0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>108</td>
<td>5</td>
<td>117</td>
<td>5 0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>108</td>
<td>5</td>
<td>117</td>
<td>5 0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>108</td>
<td>5</td>
<td>117</td>
<td>5 0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>96</td>
<td>4</td>
<td>105</td>
<td>2 1</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>72</td>
<td>4</td>
<td>79</td>
<td>2 2</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>96</td>
<td>5</td>
<td>105</td>
<td>4 1</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>96</td>
<td>5</td>
<td>105</td>
<td>4 1</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>96</td>
<td>5</td>
<td>105</td>
<td>4 1</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>70</td>
<td>4</td>
<td>77</td>
<td>2 2</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>70</td>
<td>4</td>
<td>77</td>
<td>2 2</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>84</td>
<td>4</td>
<td>91</td>
<td>4 0</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>108</td>
<td>5</td>
<td>117</td>
<td>5 0</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>84</td>
<td>4</td>
<td>91</td>
<td>4 0</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>70</td>
<td>4</td>
<td>77</td>
<td>2 2</td>
<td>3</td>
</tr>
<tr>
<td>合计</td>
<td>1482</td>
<td>74</td>
<td>1629</td>
<td>62 12</td>
<td>51</td>
</tr>
</tbody>
</table>

With a little inspection, we can see all the free ports are smaller than 8. Therefore, the calculations are correct. We can use this data to proceed with the layout diagrams.
**Building layout diagram:**

**54-unit Building (Building No. 1, 2, 3, 4, 5, and 14):**

Switch Needed: 5 units of Ether-FSH24RS  
Free Ports: 3

**48-unit Building (Building No. 6, 8, 9, and 10):**

Switch Needed: 4 units of Ether-FSH24RS, 1 unit of Ether-FSH16D  
Free Ports: 7
**Building Layout Diagram:**

**42-unit Building (Building No.13 and 15):**

Switch Needed: 4 units of Ether-FSH24RS  
Free Ports: 5

**35-unit Building (Building No. 11, 12, 16) or 36-unit Building (Building No. 7):**

Switch Needed: 2 units of Ether-FSH24RS, 2 units of Ether-FSH16D  
Free ports: 3(35-unit building) or 1(36-unit building)
**Central Equipment Room:**

1. Concentrate all connections (100Base-FX) from the buildings to one backbone switch in the Central Equipment Room.
2. Ether-FSH1602G is equipped with 9.6Gbps throughput, 12 MB RAM, and 16K MAC address table. It is suitable to be a backbone switch for this project.
3. Network designer should use VLAN to separate the broadcast domain for each building, resulting in better security and performance.
4. Ether-FSH1602G has two RJ-45 Gigabit ports. One port can be used to connect to a server while another would be used to connect to an Ether-FSH24G switch.
5. Connect all ADSL routers to the Ether-FSH24G switch. The one remaining Gigabit port can be used for server connection.
6. We can connect up to 24 ADSL connections to the Ether-FSH24G switch. The bandwidth is expandable.
7. We would use the aforementioned DHCP Service provided by ADSL Routers or Setting up a dedicated DHCP server method to manage the ADSL sharing.
## Model Used For Central Equipment Room.

<table>
<thead>
<tr>
<th>Model number</th>
<th>Picture</th>
<th>Product Feature</th>
</tr>
</thead>
</table>
| Ether-FSH24G          | ![Ether-FSH24G](image1) | - 24-port 10/100BaseTX  
- 2 Gigabit Modules  
- 9.6 Gbps Throughput  
- 12 MB Memory Buffer  
- 16K MAC Address Table  
- 432 ×237 ×44 mm  
- 19-inch Rack Mountable  
- Designed for medium to large network |
| Ether-FSH1602G        | ![Ether-FSH1602G](image2) | - 16-port 10/100BaseTX  
- 2 Gigabit Ports  
- 8 VLAN Groups  
- Trunking  
- 9.6 Gbps Throughput  
- 12 MB Memory Buffer  
- 16K MAC Address Table  
- 432 ×208 ×44mm  
- 19 inch Rack-Mountable |
| OV-IP 2040            | ![OV-IP 2040](image3) | - Support ADSL/Cable Modem  
- 253 DHCP auto-configure clients  
- More than 65,000 manually configure IPs.  
- Built-in 4-port 10/100 Switch |
| OV-110TMC             | ![OV-110TMC](image4) | - 10/100BaseTX to 100BaseFX, SC Connectors  
- Up to 2KM using multimode fiber. |
Central Equipment Room Layout

100Base-FX connection from the buildings

4 to 24 ADSL Connections

Community Server

Community Server 2

Gigabit Cat.5 Connection

100Mbps Multimode Fiber

100Mbps Cat.5 Connection

OV-110TMC

ADSL Modem

Internet
**VLAN Setup:**

In a community network of this size, we should use VLAN to divide each building into separate broadcast domain. Otherwise, the broadcast traffic will become too large and eventually impede the network performance. Nevertheless, we must still let each node to share the ADSL connections and gain access to the servers. Therefore, we should create overlapping VLANs to achieve this goal.

Ether-FSH 1602G supports 8 VLAN groups. Because we have total of 16 buildings, we should group every 2 buildings as a VLAN. To evenly distribute the number of ports per VLAN groups, we can pair a high-unit building with a low-unit building. For example, a 54-unit building should group with a 35-unit building.

We must also include Port 17 (connected to the Ether-FSH24G switch) and Port 18 (connected to Community Server 1) in each VLAN group in order to share the servers and the ADSL connections.

The following table shows the VLAN group assignment (Port No. 1-16 are connected to Building No. 1-16 respectively):

<table>
<thead>
<tr>
<th>VLAN Group</th>
<th>Member Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN 1</td>
<td>1, 7, 17, 18</td>
</tr>
<tr>
<td>VLAN 2</td>
<td>2, 11, 17, 18</td>
</tr>
<tr>
<td>VLAN 3</td>
<td>3, 12, 17, 18</td>
</tr>
<tr>
<td>VLAN 4</td>
<td>4, 13, 17, 18</td>
</tr>
<tr>
<td>VLAN 5</td>
<td>5, 15, 17, 18</td>
</tr>
<tr>
<td>VLAN 6</td>
<td>6, 8, 17, 18</td>
</tr>
<tr>
<td>VLAN 7</td>
<td>9, 10, 17, 18</td>
</tr>
<tr>
<td>VLAN 8</td>
<td>14, 16, 17, 18</td>
</tr>
</tbody>
</table>

The above diagram shows the concept for VLAN 1 and 2.
**VLAN in the Building:**
The Ether-FSH24RS has built-in VLAN functions. It can configure up to 4 VLAN groups. We can also divide VLANs inside the building to decrease broadcast traffic and increase network performance.

**ADSL Sharing Methods:**

As we have mentioned about different type of ADSL sharing methods. In this project, we will employ the following method to manage ADSL sharing:
1. **DHCP Service provided by ADSL Routers** or
2. **Setting up a dedicated DHCP server**

To use the first method, we need at least 6 OV-IP2040 while using the second method only requires 4. Whichever method we choose would not change the number of switches required.

4. **DHCP Service provided by ADSL Routers** (minimum of 6 OV-IP2040)

**Requirements:**
I. Minimum of 6 OV-IP2040
II. Each router’s IP address must be set different. I.E. the first router is 192.168.1.24, the second is 192.168.2.254, …. Etc).
III. Each router’s DHCP configurable IP range must be set different. I.E. the first router is 192.168.1.1 to 192.168.1.253. The second router is 192.168.2.1 to 192.168.2.253, …etc).

**Principle:**

From the above diagram, we are connecting all the ADSL routers to the Ether-FSH24G switch. Each router’s IP address and DHCP client IP range are set differently. When a resident connect a computer to the community network. The
subsequent DHCP negotiation will occur:

V. The resident’s computer will send out a DHCP request to all routers asking for automatic IP configuration.

VI. All routers that receive this request will send out DHCP invitations to the computer.

VII. The computer will accept the first invitation and reject all subsequent offers from other routers.

VIII. The router that received the acceptance will assign the computer an IP address and gateway. From this point on, this computer will connect to internet through this router with the assigned IP address.

When a router’s DHCP clients reach the maximum allowable figure (between 0 and 253), it will no longer respond to DHCP request. The request will be handled by the next available router. Because each DHCP request is handled by a randomly chosen router, load balancing is achieved.

The biggest advantage to this method is the bandwidth expandability. When the community needs more bandwidth, they can simply add more ADSL routers and connections to the switch. Then each router’s DHCP clients can be reduced, resulting in more bandwidth per client. For example, if we increase the ADSL connections to 16. Each router’s share of DHCP clients is only 93 (1482 ports divided by 16 routers). Thus, we can change each router’s DHCP client IP range to 93.

5. Setting up a dedicated DHCP server: If the community wants to share less than 6 ADSL connections, then a dedicated DHCP server must be setup.

Clients

DHCP Server

Requirements:
I. An dedicated hardware-based or software-based DHCP server must be
setup.

II. Each router’s IP address must be set different. I.E. the first router is 192.168.1.24, the second is 192.168.2.254, …. Etc).

III. Each router’s DHCP service must be turned off.

**Principle:**

Using this method, we can setup a software based DHCP server on community server 1 or server 2. DHCP Server can be either a dedicated hardware device or software running on a computer. Windows NT server, Windows 2000 Server and Unix all have built-in DHCP server software. An dedicated DHCP server allows greater number of automatic IP configuration, and a single dedicated DHCP server should be able to serve the entire community. A dedicated DHCP server can assign IP address to a client, then assign the Gateway for which the computer can obtain Internet access. Since each router is assigned as a Gateway, the DHCP server can control which IP range can have access to which router. Load balancing is thus achieved. Like the first method, the bandwidth is expandable. But the IP range and Gateway assignment must be changed whenever new connections are added to achieve optimal load balancing.