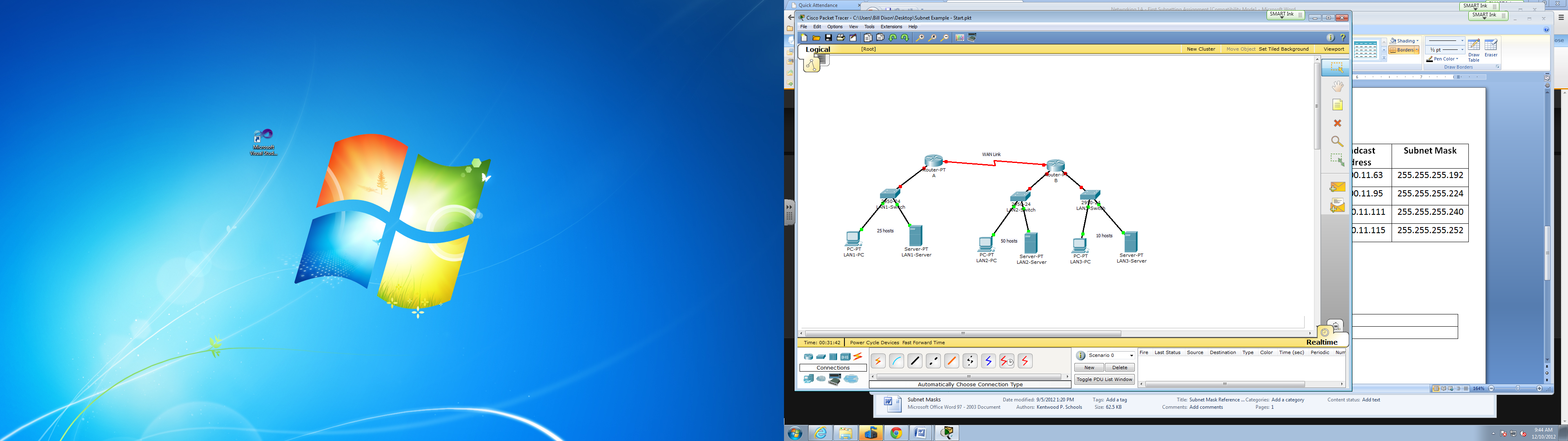
**Subnetting Introduction**

**Subnetting with Class C Networks**

**Subnetting** - The process of breaking up a Class A, B or C network into smaller chunks of IP addresses to more efficiently make use of the IP addresses currently available.

Imagine that we have the following topology. It consists of three LANS and one WAN link. Typically, we would configure this topology using four different networks. The truth is that to do so would be extremely inefficient. For example, look at the WAN link. We only need two IP addresses to accommodate the needs of the WAN link, but if we gave it an entire Class C network, it would receive 256 IP addresses and only use two of them, wasting 250+ IP addresses. With IP addresses being in short supply and high demand, we turn to subnetting to help us solve this problem.



We want to properly IP address the above topology using only one Class C network, 201.100.11.0.

Here's the steps we follow to do this:

**Step # 1** - List each LAN and WAN in order from largest to smallest. Your WAN links will always be at the end of this list.

50 hosts, 25 hosts, 10 hosts, WAN Link (2 IP addresses)

**Step # 2** - Choose the most efficient subnet size for each of your LANs and WANs. The size of a subnet must be a power of 2. (256, 128, 64, 32, 16, 8, 4). The subnet size must be bigger than the number of hosts it will accommodate, or you will run out of IP addresses. In this situation we would choose the following: 50 hosts (64 IP addresses given), 25 hosts (32 IP addresses given), 10 hosts (16 IP addresses given). WAN links are **ALWAYS** given 4 IP addresses.

**Step # 3** - In the table fill in the starting IP address for your class C network. It will be the network address for your largest subnet. You will then proceed to add the number of IP addresses you gave to each subnet to the last octet of its network address and write the result as the network address for the next subnet in the topology. Repeat this process until you have filled in all network addresses, and one line extra.

**Step # 4** - Fill in the Broadcast Address by subtracting one from the next subnet's network address. We never have an IP address fall into two different subnets and we never have a gap between our subnets. We use the extra network address to fill in the broadcast address for our WAN link.

**Step # 5** - Remember that we cannot use the network address or the broadcast address. Each subnet will have one of each. As a reminder, the first usable simply has us adding one to the last octet of the network address. The last usable is found by subtracting one from the broadcast address.

**Step # 6** - The subnet mask is used to indicate the size of the subnet. Each subnet size has a subnet mask that will be used for all devices on that subnet. The following table shows each pair of subnet size and subnet mask:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subnet Size** | **Subnet Mask** |  | **Subnet Size** | **Subnet Mask** |
| 128 | 255.255.255.128 |  | 16 | 255.255.255.240 |
| 64 | 255.255.255.192 |  | 8 | 255.255.255.248 |
| 32 | 255.255.255.224 |  | 4 | 255.255.255.252 |

Here's what the final subnetting table will look like:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Actual Subnet Size** | **IP Addresses Given** | **Network Address** | **First Usable IP Address** | **Last Usable IP Address** | **Broadcast Address** | **Subnet Mask** |
| 50 | 64 | 201.100.11.0 | 201.100.11.1 | 201.100.11.62 | 201.100.11.63 | 255.255.255.192 |
| 25 | 32 | 201.100.11.64 | 201.100.11.65 | 201.100.11.94 | 201.100.11.95 | 255.255.255.224 |
| 10 | 16 | 201.100.11.96 | 201.100.11.97 | 201.100.11.110 | 201.100.11.111 | 255.255.255.240 |
| WAN Link-2 | 4 | 201.100.11.112 | 201.100.11.113 | 201.100.11.114 | 201.100.11.115 | 255.255.255.252 |

How do I apply this information?

I treat each line in the above table as the IP scheme for each part of the network. We will follow the same rules as we have used in previous labs: Router FastEthernet interfaces get first usable IP address. PCs get second usable. Servers get last usable IP address. On WAN links, the clock rate side gets first usable, the non-clock rate side gets the second usable.

**50 Hosts LAN**

|  |  |  |  |
| --- | --- | --- | --- |
| Device | IP Address | Subnet Mask | Default Gateway |
| Router B, F0/0 | 201.100.11.1 | 255.255.255.192 | N/A |
| LAN2-PC | 201.100.11.2 | 255.255.255.192 | 201.100.11.1 |
| LAN2-Server | 201.100.11.62 | 255.255.255.192 | 201.100.11.1 |

**25 Hosts LAN**

|  |  |  |  |
| --- | --- | --- | --- |
| Device | IP Address | Subnet Mask | Default Gateway |
| Router A, F0/0 | 201.100.11.65 | 255.255.255.224 | N/A |
| LAN1-PC | 201.100.11.66 | 255.255.255.224 | 201.100.11.65 |
| LAN1-Server | 201.100.11.94 | 255.255.255.224 | 201.100.11.65 |

**10 Hosts LAN**

|  |  |  |  |
| --- | --- | --- | --- |
| Device | IP Address | Subnet Mask | Default Gateway |
| Router B, F1/0 | 201.100.11.97 | 255.255.255.240 | N/A |
| LAN3-PC | 201.100.11.98 | 255.255.255.240 | 201.100.11.97 |
| LAN3-Server | 201.100.11.110 | 255.255.255.240 | 201.100.11.97 |

**WAN Link**

|  |  |  |
| --- | --- | --- |
| **Device** | **IP Address** | **Subnet Mask** |
| Router A - S2/0 (clock rate) | 201.100.11.113 | 255.255.255.252 |
| Router B - S2/0 (non-clock rate) | 201.100.11.114 | 255.255.255.252 |

Reminders:

1. On each LAN, every device will have the same subnet mask and default gateway. Each device will have a different IP address assigned to it.

2. You cannot use the network address or broadcast address on devices.

3. You only have two usable IP addresses on each WAN link, if you choose the proper subnet mask (255.255.255.252)

4. Watch out for subnet sizes that are powers of 2 or powers of 2 -1. You must go UP one subnet size to accommodate these since you cannot use 2 of the IP addresses. For example, if you needed to accommodate 8 hosts, you could not give it just 8 IP addresses because once you factor in the network address and broadcast address, you would only have six IP addresses left. We would actually have to give that subnet 16 IP address to meet its needs.