

VLSM

Subnetting



July 12, 2023

**Scenario 1: A university is setting up a network for its campus. They have the IP address range**

**172.16.0.0, 255.255.0.0. They need to create eight subnets to accommodate different departments,**

**each with varying host ID requirements:**

1. **Department A: 200 hosts**
2. **Department B: 120 hosts**
3. **Department C: 90 hosts**
4. **Department D: 60 hosts**
5. **Department E: 40 hosts**
6. **Department F: 30 hosts**
7. **Department G: 20 hosts**
8. **Department H: 10 hosts**

**IP: 172.16.0.0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Department | Required Host | Subnet Mask | IP Address | Subnet Range |
| A | **200** | **255.255.255.0** | **172.16.0.0** | **172.16.0.0 - 172.16.0.255 (First and last for Broadcast)** |
| B | **120** | **255.255.255.128** | **172.16.1.0** | **172.16.1.0 - 172.16.1.127 (First and last for Broadcast** |
| C | **90** | **255.255.255.128** | **172.16.1.128** | **172.16.1.128 - 172.16.1.255 (First and last for Broadcast** |
| D | **60** | **255.255.255.192** | **172.16.2.0** | **172.16.2.0 - 172.16.2.63 (First and last for Broadcast** |
| E | **40** | **255.255.255.192** | **172.16.2.64** | **172.16.2.64 - 172.16.2.127 (First and last for Broadcast** |
| F | **30** | **255.255.255.224** | **172.16.2.128** | **172.16.2.128 - 172.16.2.159 (First and last for Broadcast** |
| G | **20** | **255.255.255.224** | **172.16.2.160** | **172.16.2.160 - 172.16.2.191 (First and last for Broadcast** |
| H | **10** | **255.255.255.240** | **172.16.2.192** | **172.16.2.192 - 172.16.2.207 (First and last for Broadcast** |

**EXPLANATION:**

1. **Department A:** 
   1. **Subnet Mask:** 2^8 = 256. We need at least 8 bits for the host portion of the IP address.

The remaining bits (32 - 8 = 24) will be used for the network portion.

Convert 24 bits to decimal: 255.255.255.0

* 1. **Usable Host:** 256 - 2 = 254 usable host addresses. (-2 for first and last IP, it is used for broadcast network)

1. **Department B:** 
   1. **Subnet Mask:** We choose a /25 subnet mask (255.255.255.128) because it provides 126 usable host addresses. With a /25 subnet mask, we have 128 total addresses (2^7).
   2. **Usable Host:** 128 – 2 = 126 usable host
2. **Department C:** 
   1. **Subnet Mask:** We chose a /25 subnet mask (255.255.255.128) because it provides enough host addresses. With a /25 subnet mask, we have 128 total addresses (2^7).
   2. **Usable Host:** 128 – 2 = 126
3. **Department D:** 
   1. **Subnet Mask:** We selected a /26 subnet mask (255.255.255.192) because it provides 62 usable host addresses. With a /26 subnet mask, we have 64 total addresses (2^6).
   2. **Usable Host:** 64 – 2 – 62
4. **Department E:** 
   1. **Subnet Mask:** We used a /26 subnet mask (255.255.255.192) because it provides enough host addresses. With a /26 subnet mask, we have 64 total addresses (2^6).
   2. **Usable Host:** 64 – 2 – 62 (-2 for first and last IP, it is for broadcast network)
5. **Department F:** 
   1. **Subnet Mask:** We selected a /27 subnet mask (255.255.255.224) because it provides 30 usable host addresses. With a /27 subnet mask, we have 32 total addresses (2^5).
   2. **Usable Host:** 32 – 2 = 30
6. **Department G:** 
   1. **Subnet Mask:** We used a /27 subnet mask (255.255.255.224) because it provides enough host addresses. With a /27 subnet mask, we have 32 total addresses (2^5).
   2. **Usable Host:** 32 – 2 = 30
7. **Department H:** 
   1. **Subnet Maks:** /28 subnet mask has 28 bits set to 1, which translates to 255.255.255.240 in decimal form.
   2. **Usable Host:** In a /28 subnet, we subtract 2 from the total number of addresses. The reason for subtracting 2 is because the first address is the network address, and the last address is the broadcast address, both of which are reserved and not usable for hosts. 2^4 = 16, 16 – 2 = 14 Usable host

**Scenario 2: A Corporation is setting up a network for their office. They have been allocated**

**the IP address range 10.0.0.0, 255.0.0.0. They need to create four subnets to accommodate the**

**following departments with their respective host ID requirements:**

1. **Department A: 35 hosts**
2. **Department B: 25 hosts**
3. **Department C: 15 hosts**
4. **Department D: 12 hosts**
5. **Department E: 8 hosts**
6. **Department F: 5 hosts**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Department | Required Host | Subnet Mask | IP Address | Usable Range | Broadcast Address |
| A | **35** | **255.255.255.192** | **10.0.0.0** | **10.0.0.1 - 10.0.0.62** | **10.0.0.63** |
| B | **25** | **255.255.255.224** | **10.0.0.64** | **10.0.0.65 - 10.0.0.94** | **10.0.0.95** |
| C | **15** | **255.255.255.240** | **10.0.0.96** | **10.0.0.97 - 10.0.0.110** | **10.0.0.111** |
| D | **12** | **255.255.255.240** | **10.0.0.112** | **10.0.0.113 - 10.0.0.126** | **10.0.0.127** |
| E | **8** | **255.255.255.240** | **10.0.0.128** | **10.0.0.129 - 10.0.0.142** | **10.0.0.143** |
| F | **5** | **255.255.255.248** | **10.0.0.144** | **10.0.0.145 - 10.0.0.150** | **10.0.0.151** |

1. **Department A:** No. of host ids required are 35 (35+2),

2^6=64 will be acquired. For the IP address ‘10.0.0.0’, n will be 6.

1. **Department B: I**P address will be 10.0.0.64. Dep B requires 25 host ids (25+2),

2^5=32 will be acquired. Thus, n will be 5.

1. **Department C:** IP address will be 10.0.0.96. Dep C requires 15 host ids (15+2),

2^5=32 will be acquired. Thus, n will be 5.

1. **Department D:** IP address will be 10.0.0.112. Dep D requires 12 host ids (12+2),

2^4=16 will be acquired. Thus, n will be 4.

1. **Department E:** The updated IP address will be 10.0.0.128. The Dep E requires 8 host ids (8+2), 2^4=16 will be acquired. Thus, n will be 4.
2. **Department F:** IP address will be 10.0.0.144. Dep F requires 5 host ids (5+2),
   1. 2^3=8 will be acquired. Thus, n will be 3.