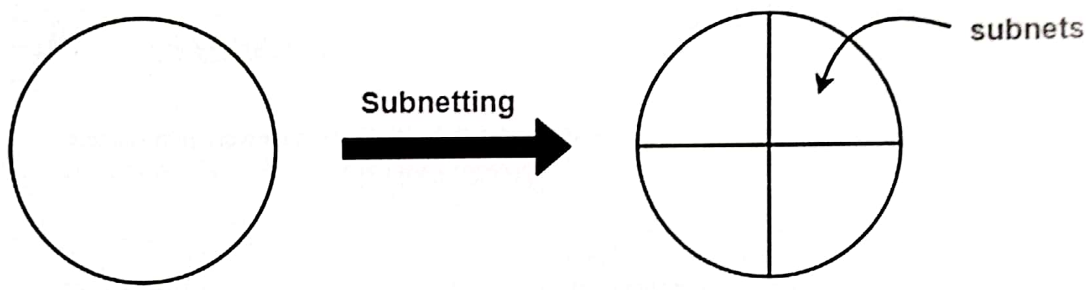
Subnetting in Networking-

In networking,

- The process of dividing a single network into multiple sub networks is called as **subnetting.**
- The sub networks so created are called as **subnets.**

Example-

Following diagram shows the subnetting of a big single network into 4 smaller subnets-



Big Single Network **Division of network into 4 subnets**

Advantages-

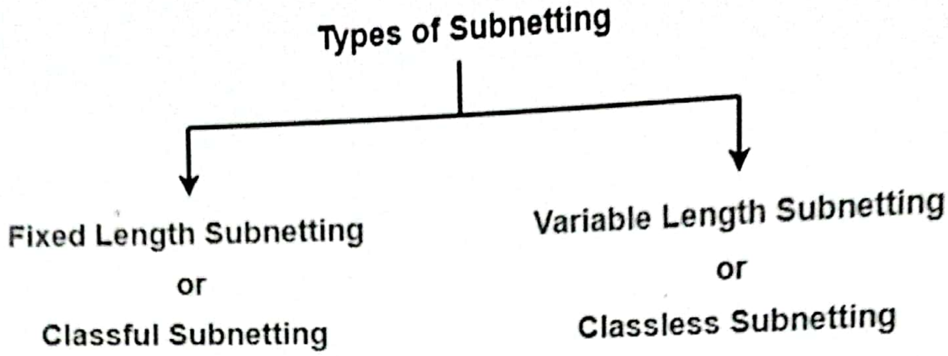
The two main advantages of subnetting a network are-

- It improves the security.
- The maintenance and administration of subnets is easy.

Subnet ID-

- Each subnet has its unique network address known as its **Subnet ID.**
- The subnet ID is created by borrowing some bits from the Host ID part of the IP Address.
- The number of bits borrowed depends on the number of subnets created.

Types of Subnetting-



1. Fixed Length Subnetting
2. Variable Length Subnetting

1. Fixed Length Subnetting-

Fixed length subnetting also called as **classful subnetting** divides the network into subnets where-

- All the subnets are of same size.
- All the subnets have equal number of hosts.
- All the subnets have same subnet mask.

2. Variable Length Subnetting-

Variable length subnetting also called as **classless subnetting** divides the network into subnets where-

- All the subnets are not of same size.
- All the subnets do not have equal number of hosts.
- All the subnets do not have same subnet mask.

Subnetting Examples-

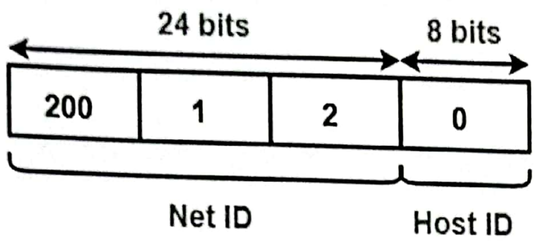
Now, we shall discuss some examples of subnetting a network-

Example-01:

Consider-

- We have a big single network having IP Address 200.1.2.0.
- We want to do subnetting and divide this network into 2 subnets.

Clearly, the given network belongs to class C.

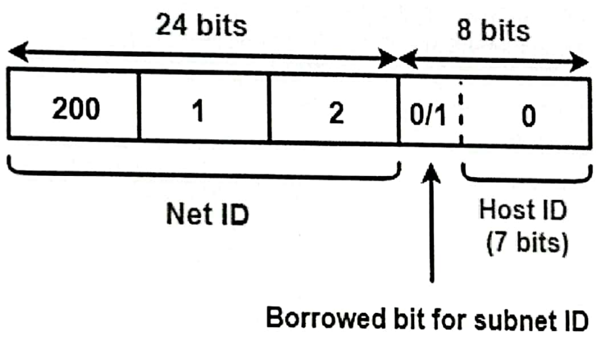


Also Read- **Classes of IP Address**

For creating two subnets and to represent their subnet IDs, we require 1 bit.

So,

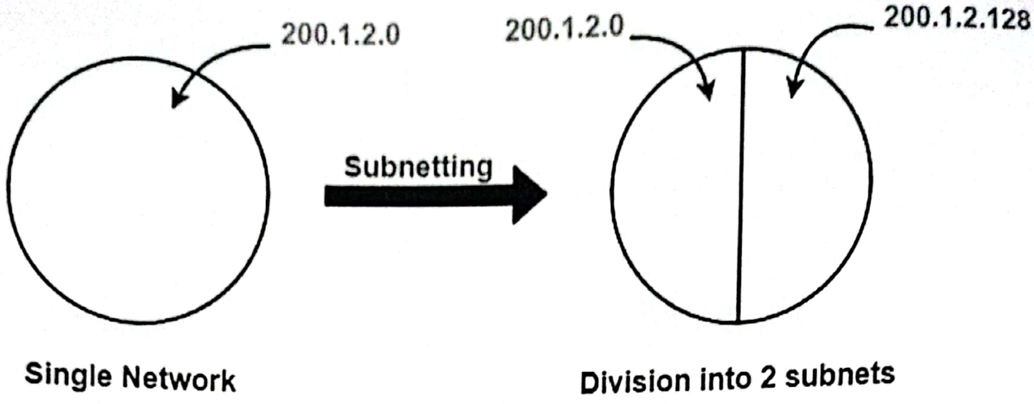
- We borrow one bit from the Host ID part.
- After borrowing one bit, Host ID part remains with only 7 bits.



- If borrowed bit = 0, then it represents the first subnet.
- If borrowed bit = 1, then it represents the second subnet.

IP Address of the two subnets are-

- 200.1.2.00000000 = 200.1.2.0
- 200.1.2.10000000 = 200.1.2.128



For 1st Subnet-

- IP Address of the subnet = 200.1.2.0
- Total number of IP Addresses = 2^7 = 128
- Total number of hosts that can be configured = 128 – 2 = 126
- Range of IP Addresses = [200.1.2.**0**0000000, 200.1.2.**0**1111111] = [200.1.2.0, 200.1.2.127]
- Direct Broadcast Address = 200.1.2.**0**1111111 = 200.1.2.127
- Limited Broadcast Address = 255.255.255.255

For 2nd Subnet-

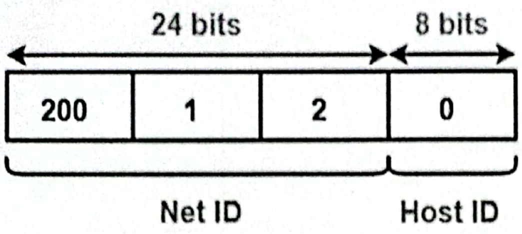
- IP Address of the subnet = 200.1.2.128
- Total number of IP Addresses = 2^7 = 128
- Total number of hosts that can be configured = 128 – 2 = 126
- Range of IP Addresses = [200.1.2.**1**0000000, 200.1.2.**1**1111111] = [200.1.2.128, 200.1.2.255]
- Direct Broadcast Address = 200.1.2.**1**1111111 = 200.1.2.255
- Limited Broadcast Address = 255.255.255.255

Example-02:

Consider-

- We have a big single network having IP Address 200.1.2.0.
- We want to do subnetting and divide this network into 4 subnets.

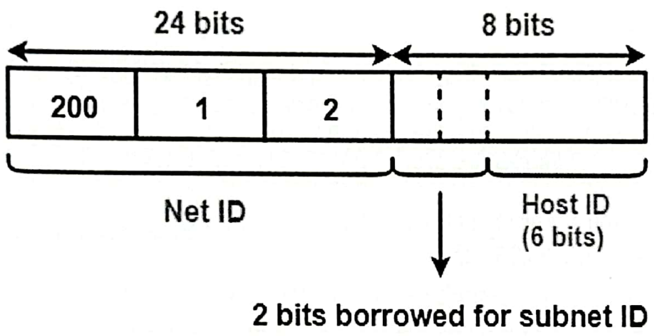
Clearly, the given network belongs to class C.



For creating four subnets and to represent their subnet IDs, we require 2 bits.

So,

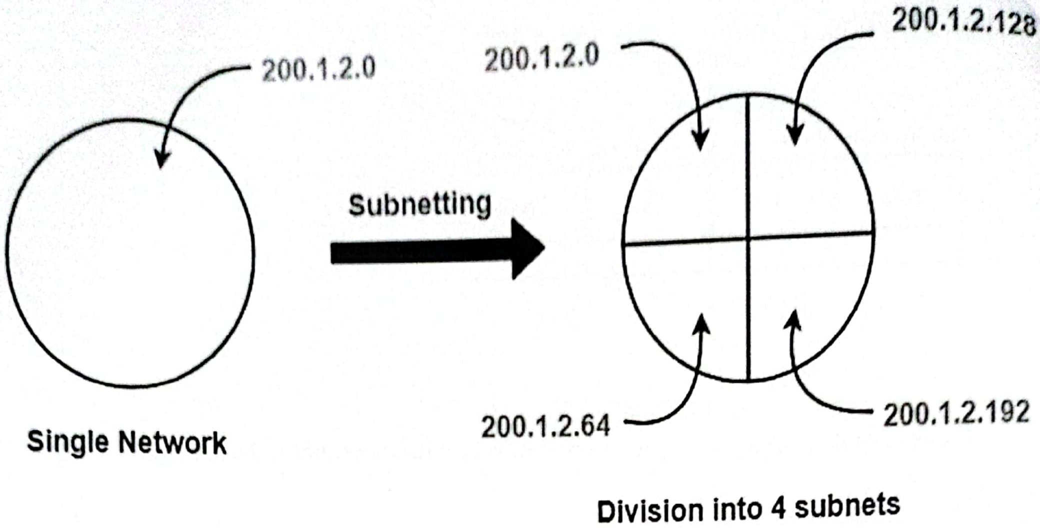
- We borrow two bits from the Host ID part.
- After borrowing two bits, Host ID part remains with only 6 bits.



- If borrowed bits = 00, then it represents the 1st subnet.
- If borrowed bits = 01, then it represents the 2nd subnet.
- If borrowed bits = 10, then it represents the 3rd subnet.
- If borrowed bits = 11, then it represents the 4th subnet.

IP Address of the four subnets are-

- 200.1.2.**00**000000 = 200.1.2.0
- 200.1.2.**01**000000 = 200.1.2.64
- 200.1.2.**10**000000 = 200.1.2.128
- 200.1.2.**11**000000 = 200.1.2.192



For 1st Subnet-

- IP Address of the subnet = 200.1.2.0
- Total number of IP Addresses = 2^6 = 64
- Total number of hosts that can be configured = 64 – 2 = 62
- Range of IP Addresses = [200.1.2.**00**000000, 200.1.2.**00**111111] = [200.1.2.0, 200.1.2.63]
- Direct Broadcast Address = 200.1.2.**00**111111 = 200.1.2.63
- Limited Broadcast Address = 255.255.255.255

For 2nd Subnet-

- IP Address of the subnet = 200.1.2.64
- Total number of IP Addresses = 2^6 = 64
- Total number of hosts that can be configured = 64 – 2 = 62
- Range of IP Addresses = [200.1.2.**01**000000, 200.1.2.**01**111111] = [200.1.2.64, 200.1.2.127]
- Direct Broadcast Address = 200.1.2.**01**111111 = 200.1.2.127
- Limited Broadcast Address = 255.255.255.255

For 3rd Subnet-

- IP Address of the subnet = 200.1.2.128
- Total number of IP Addresses = 2^6 = 64
- Total number of hosts that can be configured = 64 – 2 = 62
- Range of IP Addresses = [200.1.2.**10**000000, 200.1.2.**10**111111] = [200.1.2.128, 200.1.2.191]
- Direct Broadcast Address = 200.1.2.**10**111111 = 200.1.2.191
- Limited Broadcast Address = 255.255.255.255

For 4th Subnet-

- IP Address of the subnet = 200.1.2.192
- Total number of IP Addresses = 2^6 = 64
- Total number of hosts that can be configured = 64 – 2 = 62
- Range of IP Addresses = [200.1.2.11000000, 200.1.2.11111111] = [200.1.2.192, 200.1.2.255]
- Direct Broadcast Address = 200.1.2.11111111 = 200.1.2.255
- Limited Broadcast Address = 255.255.255.255

Example-03:

Consider-

- We have a big single network having IP Address 200.1.2.0.
- We want to do subnetting and divide this network into 3 subnets.

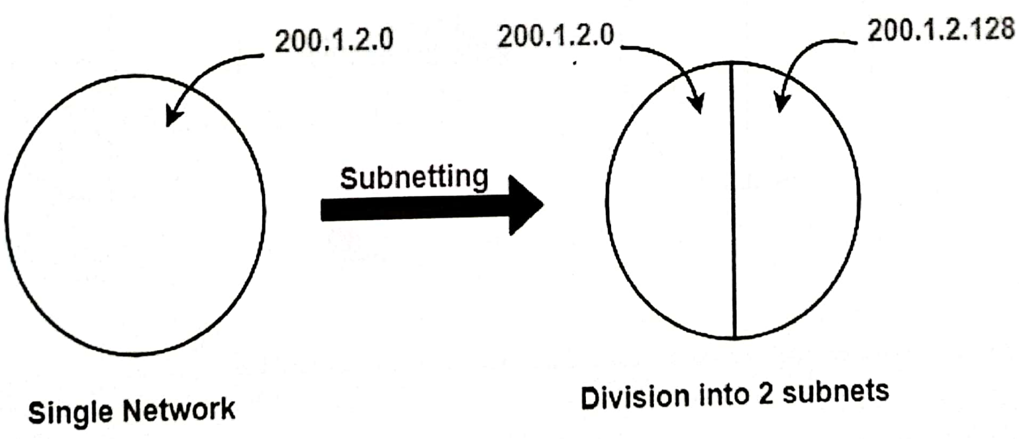
Here, the subnetting will be performed in two steps-

1. Dividing the given network into 2 subnets
2. Dividing one of the subnets further into 2 subnets

Step-01: Dividing Given Network into 2 Subnets-

The subnetting will be performed exactly in the same way as performed in Example-01.

After subnetting, we have-



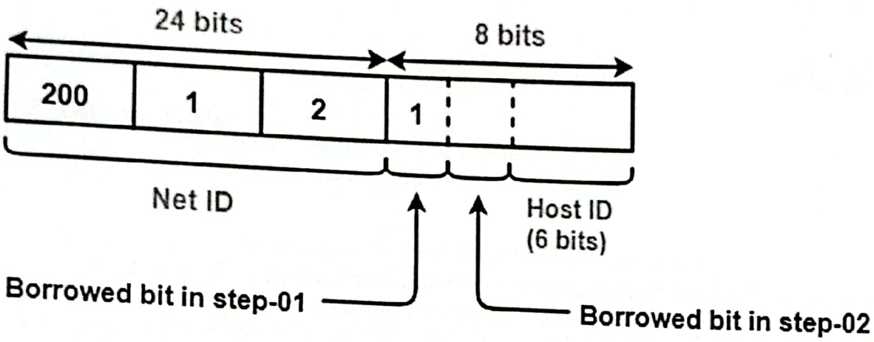
Step-02: Dividing One Subnet into 2 Subnets-

- We perform the subnetting of one of the subnets further into 2 subnets.
- Consider we want to do subnetting of the 2nd subnet having IP Address 200.1.2.128.

For creating two subnets and to represent their subnet IDs, we require 1 bit.

So,

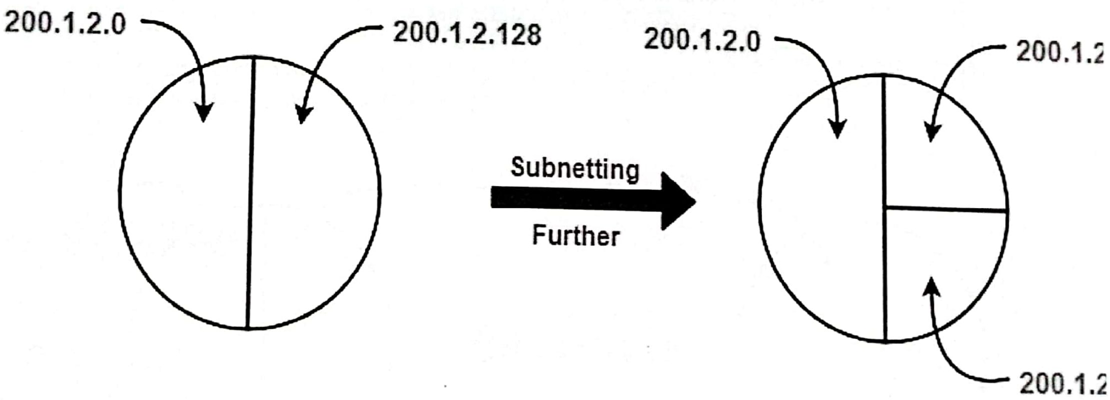
- We borrow one more bit from the Host ID part.
- After borrowing one bit, Host ID part remains with only 6 bits.



- If 2nd borrowed bit = 0, then it represents one subnet.
- If 2nd borrowed bit = 1, then it represents the other subnet.

IP Address of the two subnets are-

- 200.1.2.**1**0000000 = 200.1.2.128
- 200.1.2.**11**000000 = 200.1.2.192



Finally, the given single network is divided into 3 subnets having IP Address-

- 200.1.2.0
- 200.1.2.128
- 200.1.2.192

For 1st Subnet-

- IP Address of the subnet = 200.1.2.0
- Total number of IP Addresses = 2^7 = 128
- Total number of hosts that can be configured = 128 – 2 = 126
- Range of IP Addresses = [200.1.2.**0**0000000, 200.1.2.**0**1111111] = [200.1.2.0, 200.1.2.127]
- Direct Broadcast Address = 200.1.2.**0**1111111 = 200.1.2.127
- Limited Broadcast Address = 255.255.255.255

For 2nd Subnet-

- IP Address of the subnet = 200.1.2.128
- Total number of IP Addresses = 2^6 = 64
- Total number of hosts that can be configured = 64 – 2 = 62
- Range of IP Addresses = [200.1.2.**10**000000, 200.1.2.**10**111111] = [200.1.2.128, 200.1.2.191]
- Direct Broadcast Address = 200.1.2.**10**111111 = 200.1.2.191
- Limited Broadcast Address = 255.255.255.255

For 3rd Subnet-

- IP Address of the subnet = 200.1.2.192
- Total number of IP Addresses = 2^6 = 64
- Total number of hosts that can be configured = 64 – 2 = 62
- Range of IP Addresses = [200.1.2.**11**000000, 200.1.2.**11**111111] = [200.1.2.192, 200.1.2.255]
- Direct Broadcast Address = 200.1.2.**11**111111 = 200.1.2.255
- Limited Broadcast Address = 255.255.255.255

Disadvantages of Subnetting-

Point-01:

Subnetting leads to loss of IP Addresses.

During subnetting,

- We have to face a loss of IP Addresses.

- This is because two IP Addresses are wasted for each subnet.
- One IP address is wasted for its network address.
- Other IP Address is wasted for its direct broadcasting address.

Point-02:

Subnetting leads to complicated communication process.

After subnetting, the communication process becomes complex involving the following 4 steps-

1. Identifying the network
2. Identifying the sub network
3. Identifying the host
4. Identifying the process

PRACTICE PROBLEMS BASED ON SUBNETTING IN NETWORKING-

Problem-01:

Suppose a network with IP Address 192.16.0.0. is divided into 2 subnets, find number of hosts per subnet.

Also for the first subnet, find-

1. Subnet Address
2. First Host ID
3. Last Host ID
4. Broadcast Address

Solution-

- Given IP Address belongs to class C.
- So, 24 bits are reserved for the Net ID.
- The given network is divided into 2 subnets.
- So, 1 bit is borrowed from the host ID part for the subnet IDs.
- Then, Number of bits remaining for the Host ID = 7.
- Thus, Number of hosts per subnet = 2^7 = 128.

For 1st Subnet-

- Subnet Address = First IP Address = 192.16.0.00000000 = 172.16.0.0
- First Host ID = 192.16.0.00000001 = 192.16.0.1
- Last Host ID = 192.16.0.01111110 = 192.16.0.126
- Broadcast Address = Last IP Address = 192.16.0.01111111 = 172.16.0.127

Problem-02:

What is **not true** about subnetting?

A. It is applied for a single network
B. It is used to improve security
C. Bits are borrowed from network portion
D. Bits are borrowed from Host portion

Solution-

Clearly, Option (C) is correct.

Problem-03:

In a class B, network on the internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts per subnet?

A. 4096
B. 4094
C. 4092
D. 4090

Solution-

- Number of bits reserved for network ID in the given subnet mask = 20.
- So, Number of bits reserved for Host ID = 32 – 20 = 12 bits.
- Thus, Number of hosts per subnet = $2^{12} - 2 = 4094$.
- In class B, 16 bits are reserved for the network.
- So, Number of bits reserved for subnet ID = 20 – 16 = 4 bits.
- Number of subnets possible = $2^4 = 16$.
- Thus, Option (B) is correct.

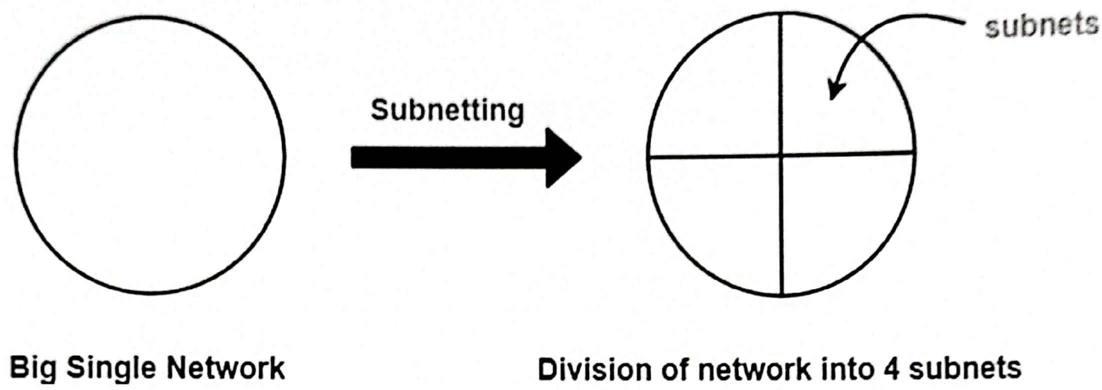
To gain better understanding about IPv4 Subnetting,

Subnetting in Networking-

Before you go through this article, make sure that you have gone through the previous article on **Subnetting**.

We have discussed-

- Subnetting is a process of dividing a single network into multiple sub networks.
- The number of sub networks created depends upon the requirements.



Subnet Mask-

Subnet mask is a 32 bit number which is a sequence of 1's followed by a sequence of 0's where-

- 1's represent the global network ID part and the subnet ID part.
- 0's represent the host ID part.

How to Calculate Subnet Mask?

For any given IP Address, the subnet mask is calculated-

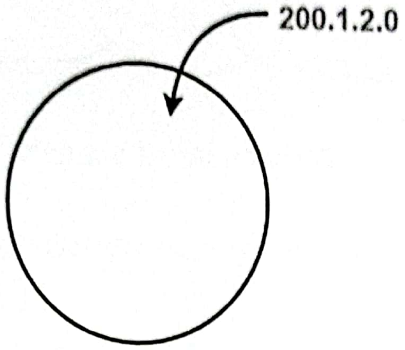
- By setting all the bits reserved for network ID part and subnet ID part to 1.
- By setting all the bits reserved for host ID part to 0.

Subnet Mask Examples-

Now, let us discuss some examples on how to calculate subnet mask for any given network-

Example-01:

Consider we have a network having IP Address 200.1.2.0.



Single Network

Clearly, this IP Address belongs to class C.

In class C-

- 24 bits are reserved for the Network ID part.
- 8 bits are reserved for the Host ID part.

Subnet mask is obtained-

- By setting the first 24 bits to 1.
- By setting the remaining 8 bits to 0.

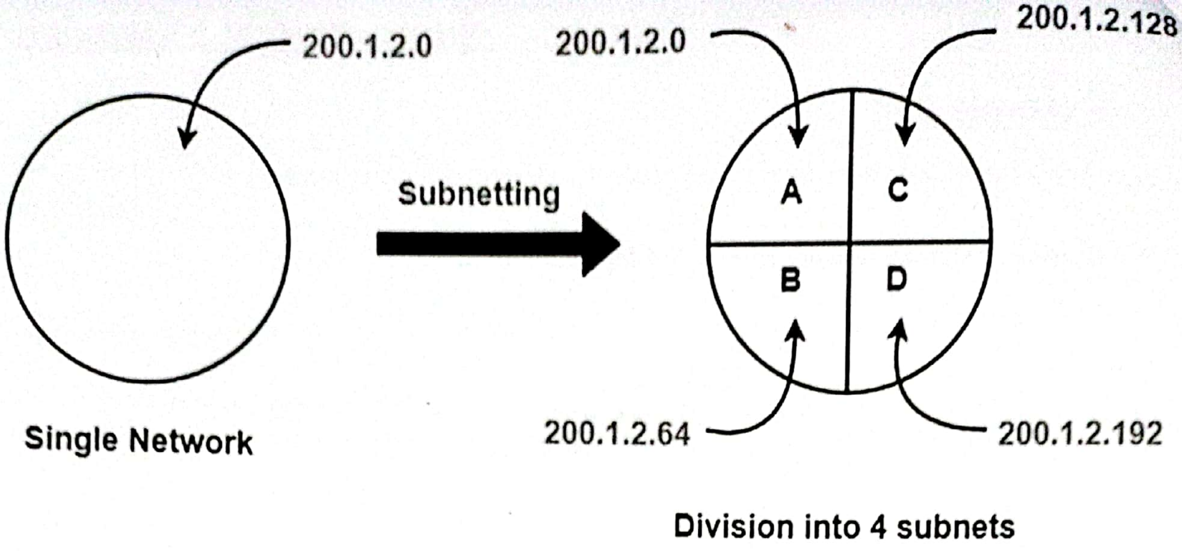
So, Subnet mask

= 11111111.11111111.11111111.00000000

= 255.255.255.0

Example-02:

Consider a single network having IP Address 200.1.2.0 is divided into 4 subnets as shown-



Now, let us calculate the mask subnet for each subnet.

For each subnet-

- 24 bits identify the global network.
- 2 bits identify the subnet.
- 6 bits identify the host.

For each subnet, subnet mask is obtained-

- By setting the first 26 bits to 1.
- By setting the remaining 6 bits to 0.

So, Subnet mask

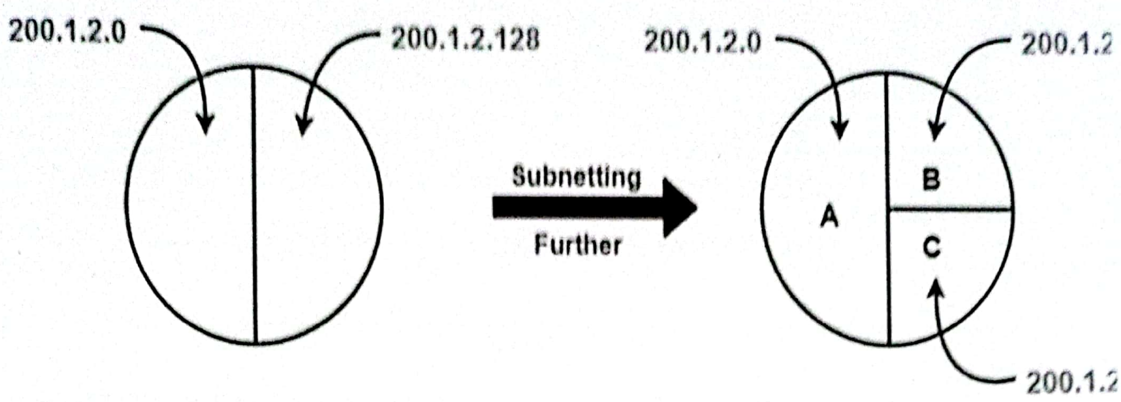
= 11111111.11111111.11111111.11000000

= 255.255.255.192

NOTE
In fixed length subnetting,
All the subnets have same subnet mask since the size of each subnet is same.

Example-03:

Consider a single network having IP Address 200.1.2.0 is divided into 3 subnets as shown-



Now, let us calculate the subnet mask for each subnet.

For Subnet A-

For subnet A-

- 24 bits identify the global network.
- 1 bit identify the subnet.
- 7 bits identify the host.

For subnet A, subnet mask is obtained-

- By setting the first 25 bits to 1.
- By setting the remaining 7 bits to 0.

So, Subnet mask

= 11111111.11111111.11111111.10000000

= 255.255.255.128

For Subnet B And Subnet C-

For subnet B and subnet C-

- 24 bits identify the global network.
- 2 bits identify the subnet.
- 6 bits identify the host.

For subnet B and subnet C, subnet mask is obtained-

- By setting the first 26 bits to 1.

- By setting the remaining 6 bits to 0.

So, Subnet mask

= 11111111.11111111.11111111.11000000

= 255.255.255.192

NOTE
In variable length subnetting,
All the subnets do not have same subnet mask since the size of each subnet is not same.

Use of Subnet Mask-

- Subnet mask is used to determine to which subnet the given IP Address belongs to.
- To know more, **Read here**.

Important Notes-

Note-01:

Default mask for different classes of IP Address are-

- Default subnet mask for Class A = 255.0.0.0
- Default subnet mask for Class B = 255.255.0.0
- Default subnet mask for Class C = 255.255.255.0

Also Read- Classes of IP Address

Note-02:

- Network size is the total number of hosts present in it.
- Networks of same size always have the same subnet mask.
- Networks of different size always have the different subnet mask.

Note-03:

- For a network having larger size, its subnet mask will be smaller (number of 1's will be less).
- For a network having smaller size, its subnet mask will be larger (number of 1's will be more).

PRACTICE PROBLEMS BASED ON SUBNET MASK-

Problem-01:

If the subnet mask 255.255.255.128 belongs to class C, find-

1. Number of subnets
2. Number of hosts in each subnet

Solution-

Given subnet mask

= 255.255.255.128

= 11111111.11111111.11111111.10000000

Since 25 bits contain the value 1 and 7 bits contain the value 0, so-

- Number of Net ID bits + Number of Subnet ID bits = 25
- Number of Host ID bits = 7

Now,

- It is given that subnet mask belongs to class C.
- So, Number of Net ID bits = 24.

Substituting in the above equation, we get-

Number of Subnet ID bits

= 25 – 24

= 1

Thus,

$$\boxed{\text{Number of subnets} = 2^1 = 2}$$

Since number of Host ID bits = 7, so-

$$\boxed{\text{Number of hosts per subnet} = 2^7 - 2 = 126}$$

Problem-02:

If a class B network has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet?

A. 1022
B. 1023
C. 2046
D. 2047

Solution-

Given subnet mask

= 255.255.248.0

= 11111111.11111111.11111000.00000000

Since 21 bits contain the value 1 and 11 bits contain the value 0, so-

- Number of Net ID bits + Number of Subnet ID bits = 21
- Number of Host ID bits = 11

Since number of Host ID bits = 11, so-

$$\boxed{\text{Number of hosts per subnet} = 2^{11} - 2 = 2046}$$

Thus, Option (C) is correct.

CamScanner

To gain better understanding about Subnet Mask,

Problems-01 to 09:

Consider the following subnet masks-

1. 255.0.0.0
2. 255.128.0.0
3. 255.192.0.0
4. 255.240.0.0
5. 255.255.0.0
6. 255.255.254.0
7. 255.255.255.0
8. 255.255.255.224
9. 225.255.255.240

For each subnet mask, find-

A. Number of hosts per subnet
B. Number of subnets if subnet mask belongs to class A
C. Number of subnets if subnet mask belongs to class B
D. Number of subnets if subnet mask belongs to class C
E. Number of subnets if total 10 bits are used for the global network ID

Solutions-

All the problems are solved below one by one-

Solution-01:

Given subnet mask is 255.0.0.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 8
- Number of Host ID bits = 24

Part-A:

Since number of Host ID bits = 24, so-

Number of hosts per subnet = $2^{24} - 2$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 8 – 8 = 0

Thus,

Number of subnets = $2^0 = 1$

Thus, there will be only one single network.

Part-C:

- First two octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class B.

Part-D:

- First three octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class C.

Part-E:

- First 10 bits of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not use 10 bits for the Network ID.

NOTE-

- 255.0.0.0 is the default mask for class A.

Solution-02:

Given subnet mask is 255.128.0.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 9
- Number of Host ID bits = 23

Part-A:

Since number of Host ID bits = 23, so-

$$\boxed{\text{Number of hosts per subnet} = 2^{23} - 2}$$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 9 – 8 = 1

Thus,

$$\boxed{\text{Number of subnets} = 2^{1} = 2}$$

Part-C:

- First two octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class B.

Part-D:

- First three octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class C.

Part-E:

- First 10 bits of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not use 10 bits for the Network ID.

Solution-03:

Given subnet mask is 255.192.0.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 10
- Number of Host ID bits = 22

Part-A:

Since number of Host ID bits = 22, so-

Number of hosts per subnet = $2^{22} - 2$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 10 – 8 = 2

Thus,

Number of subnets = $2^2 = 4$

Part-C:

- First two octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class B.

Part-D:

- First three octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class C.

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 10 – 10 = 0

Thus,

$$\boxed{\text{Number of subnets} = 2^0 = 1}$$

Thus, there will be only one single network.

Solution-04:

Given subnet mask is 255.240.0.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 12
- Number of Host ID bits = 20

Part-A:

Since number of Host ID bits = 20, so-

$$\boxed{\text{Number of hosts per subnet} = 2^{20} - 2}$$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 12 – 8 = 4

Thus,

$$\boxed{\text{Number of subnets} = 2^4 = 16}$$

Part-C:

- First two octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class B.

Part-D:

- First three octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class C.

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 12 – 10 = 2

Thus,

$$\boxed{\text{Number of subnets} = 2^2 = 4}$$

Solution-05:

Given subnet mask is 255.255.0.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 16
- Number of Host ID bits = 16

Part-A:

Since number of Host ID bits = 16, so-

Number of hosts per subnet = $2^{16} - 2$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 16 – 8 = 8

Thus,

Number of subnets = 2^8

Part-C:

If the given subnet mask belongs to class B, then number of Net ID bits = 16.

Substituting in the above equation, we get-

Number of Subnet ID bits = 16 – 16 = 0

Thus,

Number of subnets = $2^0 = 1$

Part-D:

- First three octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class C.

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 16 – 10 = 6

Thus,

Number of subnets = 2^6 = 64

NOTE-

- 255.255.0.0 is the default mask for class B.

Solution-06:

Given subnet mask is 255.255.254.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 23
- Number of Host ID bits = 9

Part-A:

Since number of Host ID bits = 9, so-

Number of hosts per subnet = $2^9 - 2$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 23 – 8 = 15

$$\boxed{\text{Number of subnets} = 2^{15}}$$

Part-C:

If the given subnet mask belongs to class B, then number of Net ID bits = 16.

Substituting in the above equation, we get-

Number of Subnet ID bits = 23 – 16 = 7

Thus,

$$\boxed{\text{Number of subnets} = 2^{7}}$$

Part-D:

- First three octets of the subnet mask are not completely filled with 1's.
- So, given subnet mask can not belong to class C.

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 23 – 10 = 13

Thus,

$$\boxed{\text{Number of subnets} = 2^{13}}$$

Solution-07:

Given subnet mask is 255.255.255.0

So,

- Number of Net ID bits + Number of Subnet ID bits = 24
- Number of Host ID bits = 8

Part-A:

Since number of Host ID bits = 8, so-

Number of hosts per subnet = $2^8 - 2$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 24 – 8 = 16

Thus,

Number of subnets = 2^{16}

Part-C:

If the given subnet mask belongs to class B, then number of Net ID bits = 16.

Substituting in the above equation, we get-

Number of Subnet ID bits = 24 – 16 = 8

Thus,

Number of subnets = 2^8

Part-D:

If the given subnet mask belongs to class C, then number of Net ID bits = 24.

Substituting in the above equation, we get-

Number of Subnet ID bits = 24 – 24 = 0

Thus,

Number of subnets = $2^0 = 1$

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 24 – 10 = 14

Thus,

Number of subnets = 2^{14}

NOTE-

- 255.255.255.0 is the default mask for class C.

Solution-08:

Given subnet mask is 255.255.255.224

So,

- Number of Net ID bits + Number of Subnet ID bits = 27
- Number of Host ID bits = 5

Part-A:

Since number of Host ID bits = 5, so-

Number of hosts per subnet = $2^5 - 2$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 27 – 8 = 19

Thus,

Number of subnets = 2^{19}

Part-C:

If the given subnet mask belongs to class B, then number of Net ID bits = 16.

Substituting in the above equation, we get-

Number of Subnet ID bits = 27 – 16 = 11

Thus,

Number of subnets = 2^{11}

Part-D:

If the given subnet mask belongs to class C, then number of Net ID bits = 24.

Substituting in the above equation, we get-

Number of Subnet ID bits = 27 – 24 = 3

Thus,

Number of subnets = 2^3 = 8

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 27 – 10 = 17

Thus,

$$\boxed{\text{Number of subnets} = 2^{17}}$$

Solution-09:

Given subnet mask is 255.255.255.240

So,

- Number of Net ID bits + Number of Subnet ID bits = 28
- Number of Host ID bits = 4

Part-A:

Since number of Host ID bits = 4, so-

$$\boxed{\text{Number of hosts per subnet} = 2^4 - 2}$$

Part-B:

If the given subnet mask belongs to class A, then number of Net ID bits = 8.

Substituting in the above equation, we get-

Number of Subnet ID bits = 28 – 8 = 20

Thus,

$$\boxed{\text{Number of subnets} = 2^{20}}$$

Part-C:

If the given subnet mask belongs to class B, then number of Net ID bits = 16.

Substituting in the above equation, we get-

Number of Subnet ID bits = 28 – 16 = 12

Thus,

Number of subnets = 2^{12}

Part-D:

If the given subnet mask belongs to class C, then number of Net ID bits = 24.

Substituting in the above equation, we get-

Number of Subnet ID bits = 28 – 24 = 4

Thus,

Number of subnets = 2^4

Part-E:

Given 10 bits are used for the Net ID part.

Substituting in the above equation, we get-

Number of Subnet ID bits = 28 – 10 = 18

Thus,

Number of subnets = 2^{18}

Problem-10:

Consider default subnet mask for a network is 255.255.255.0. How many number of subnets and hosts per subnet are possible if 'm' bits are borrowed from HID.

A. 2^m , $2^{(HID-m)} - 2$
B. 2^m , $2^{(HID-m)}$
C. $2^m - 1$, $2^{(HID-m)} - 2$
D. 2^m , (HID-m) – 2

Solution-

- Subnet mask = 255.255.255.0
- Number of bits borrowed from Host ID part = m
- So, number of subnets possible = 2^m
- Number of bits available for Hosts = HID – m
- So, number of hosts that can be configured = $2^{(HID - m)} - 2$

Thus, Option (A) is correct.

Problem-11:

If default subnet mask for a network is 255.255.255.0 and if 'm' bits are borrowed from the NID, then what could be its supernet mask?

A. $255.255.(2^{8-m} - 1) \times 2^m.0$
B. $255.255.(2^{8-m}) \times 2^m.0$
C. $255.255.(2^{8-m-1}) \times 2^{m-1}.0$
D. $255.255.(2^{8-m}) \times 2^{m-1}.0$

Solution-

Given-

- Subnet mask = 255.255.255.0
- m bits are chosen from the NID part.

Clearly, given subnet mask belongs to class C.

If m = 4, then the subnet mask = 255.255.11110000.0

Now, let us check all the options one by one.

Option-A:

Given-

- Supernet mask = $255.255.(2^{8-m} - 1) \times 2^m.0$
- Third octet = $(2^{8-m} - 1) \times 2^m$

On substituting $m = 4$, we get-

Third octet

$= 15 \times 2^4$

$= (1111)_2 \times 2^4$

= 11110000 (Performing Left shift by 4 places)

Yes, this is what the third octet should be.

Thus, Option (A) is correct.

Option-B:

Given-

- Supernet mask = 255.255.$(2^{8-m}) \times 2^m$.0
- Third octet = $(2^{8-m}) \times 2^m$

On substituting $m = 4$, we get-

Third octet

$= 16 \times 2^4$

$= (10000)_2 \times 2^4$

= 100000000 (Performing Left shift by 4 places)

This can not be true because these are 9 bits and octet can be only 8 bits.

Thus, Option (B) is incorrect.

Similarly, other options are also incorrect.

Finally, Option (A) is the only correct option.