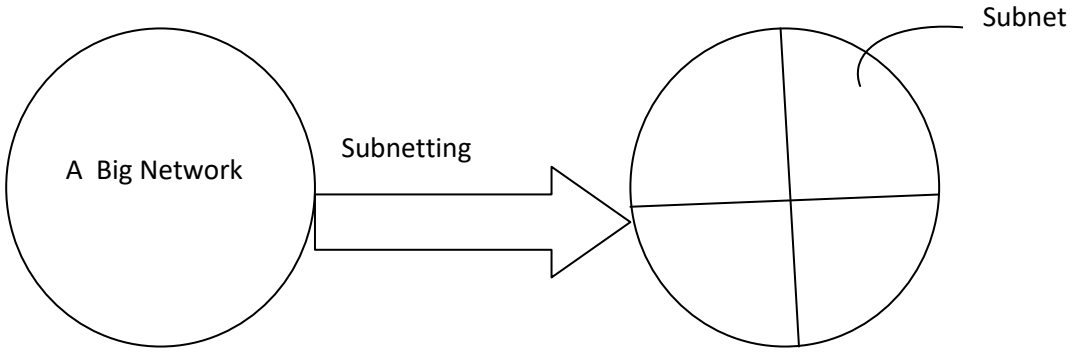
What is Subnetting in Computer Networks?

Subnetting in computer networks is an important technique that allows network administrators to divide a larger network into smaller subnetworks. Subnetting in computer networks is a technique that allows a single network to be divided into multiple smaller networks, known as subnets.

Overall, subnetting in computer networks is a technique used to better organize, allocate resources, and improve security.

Reasons for subnetting:

- Maintenance of a very big network like class A and class B is very difficult for network administrator
- Having all the computer from different departments in a company on the same network is less secure from company prospective.
- So if an organization was granted a large block in class A or B,it could divide the addresses into several contiguous group and assign each group to smaller networks(called subnets)or in rare case , share part of the addresses with neighbors.
- Conclusion:
- An organization (or an ISP) that is granted a range of an addresses may divide the range into several subranges and assign each subrange to a subnetwork(or subnet).A subnet can be divided into several sub-subnetworks. A sub subnetwork can be divided into several sub-sub-subnetworks ,and so on.



Uses of Subnetting in Computer Networks

Subnetting in computer networks has several uses, including:

- **Efficient use of IP addresses:** Subnetting allows for the creation of smaller networks within a larger network, which helps to conserve IP addresses.
- **Improved network performance:** By creating smaller networks, subnetting can help reduce network traffic and improve overall network performance.
- **Enhanced security:** Subnetting can improve network security by separating different parts of the network into smaller subnetworks, making it harder for unauthorized access.
- **Flexibility:** Subnetting allows for the creation of networks of different sizes, depending on the specific needs of the organization.
- **Routing efficiency:** Subnetting can improve routing efficiency by allowing routers to route traffic directly to the appropriate subnet instead of broadcasting it to the entire network.

- **Improved fault tolerance:** Subnetting can help improve fault tolerance by isolating network problems to specific subnets and preventing them from affecting the entire network.

Advantages of Subnetting in Computer Networks

There are several advantages of subnetting in computer networks, including:

- **Better Organization and Management:** Subnetting allows network administrators to divide a larger network into smaller, more manageable subnets. This makes it easier to allocate resources, troubleshoot network issues, and manage network traffic.
- **Improved Network Performance:** Subnetting can improve network performance by reducing network congestion and limiting the amount of broadcast traffic on the network. With smaller subnets, broadcast traffic is limited to only the devices on that subnet, reducing the overall amount of network traffic.
- **Enhanced Security:** Subnetting improves network security by isolating traffic between subnets and restricting access to sensitive information. This makes it more difficult for unauthorized users to access sensitive data or launch attacks on the network.
- **More Efficient Use of IP Addresses:** By dividing a larger network into smaller subnets, network administrators can make more efficient use of IP addresses. This is particularly important as the number of devices connected to the network continues to grow.
- **Flexibility:** Subnetting provides network administrators with greater flexibility in how they manage their networks. They can allocate resources more efficiently, troubleshoot issues more effectively, and make changes to the network more easily.

Overall, we can confidently say subnetting in computer networks is valuable for network administrators.

Disadvantages of Subnetting in Computer Networks

Although there are several advantages of subnetting, there are also some potential disadvantages of subnetting in computer networks that network administrators should consider:

- **Increased Complexity:** Subnetting can add complexity to network design and configuration, which can make it more difficult for network administrators to manage the network.
- **Requires Additional Resources:** Subnetting requires additional resources such as routers and switches, which can increase the cost of building and maintaining the network.
- **Risk of Misconfiguration:** Subnetting requires careful planning and configuration to ensure that subnets are properly set up and configured. Misconfiguration can lead to network issues, security vulnerabilities, and other problems.

- **Reduced Broadcast Capability:** By dividing a network into smaller subnets, the overall broadcast capability of the network is reduced. This can make it more difficult to broadcast messages to all devices on the network.
- **Potential for Subnet Overlap:** If subnets are not properly designed and configured, there is a risk of subnet overlap, which can lead to network issues and security vulnerabilities.

Types of Subnetting

Subnets can be of two types:

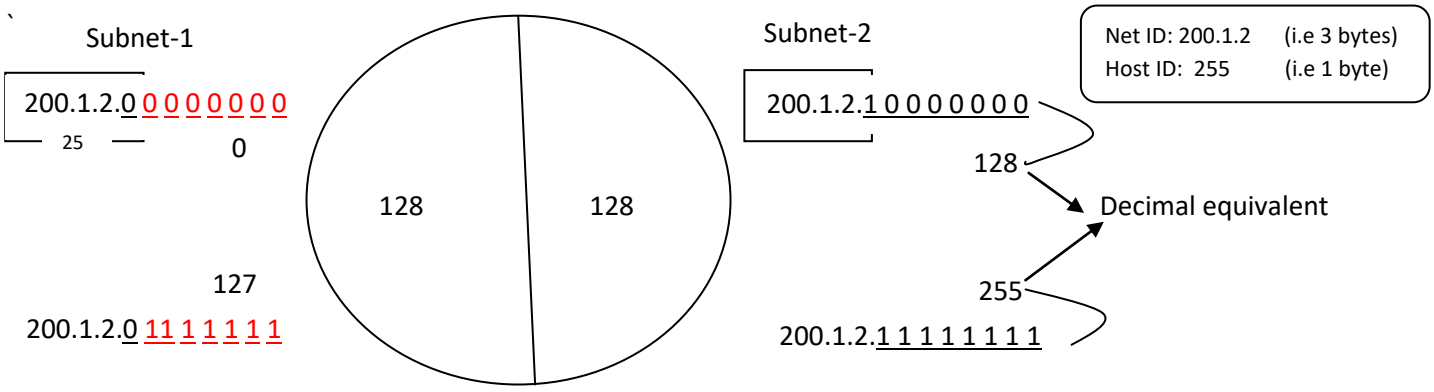
1. Fixed Length Subnetting
2. Variable Lenth Subnetting

Fixed Length Subnetting

Fixed legth subnetting(classful subnetting)divides the network into subnets such that:

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

Que. Consider the network having IP Address 200.1.2.0.Divide this network into two subnets.



1st Subnet	2nd Subnet
IP Address of the subnet /Subnet ID= 200.1.2.0	IP Address of the subnet /Subnet ID= 200.1.2.128
Direct Broadcast Address=200.1.2.01111111 =200.1.2.127	Direct Broadcast Address=200.1.2.11111111 =200.1.2.255
Total number of IP Address = 2^7=128	Total number of IP Address = 2^7=128
Range of IP Addresses= 200.1.2.0,200.1.2.127	Range of IP Addresses= 200.1.2.128,200.1.2.255
Total number of hosts that can be configured=128-2=126	Total number of hosts that can be configured=128-2=126
Range of Allocated IP Addresses=200.1.2.1 to 200.1.2.126(Real Range of IP Address)	Range of Allocated IP Addresses=200.1.2.129 to 200.1.2.254(Real Range of IP Address)
Reserved IP Addresses 200.1.2.0 and 200.1.2.127	Reserved IP Addresses 200.1.2.128 and 200.1.2.255

Que. 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.

1st Subnet	2nd Subnet
IP Address of the subnet /Subnet ID= 200.1.2.0	IP Address of the subnet /Subnet ID= 200.1.2.64
Direct Broadcast Address=200.1.2.**00**111111 =200.1.2.63	Direct Broadcast Address=200.1.2.**01**111111 =127
Total number of IP Address = 2^6=64	Total number of IP Address = 2^6=64
Range of IP Addresses= 200.1.2.0,200.1.2.63	Range of IP Addresses= 200.1.2.64,200.1.2.127
Total number of hosts that can be configured=64-2=62	Total number of hosts that can be configured=64-2=62
Range of Allocated IP Addresses=200.1.2.1 to 200.1.2.62(Real Range of IP Address)	Range of Allocated IP Addresses=200.1.2.65 to 200.1.2.126(Real Range of IP Address)
Reserved IP Addresses 200.1.2.0 and 200.1.2.63	Reserved IP Addresses 200.1.2.64 and 200.1.2.127

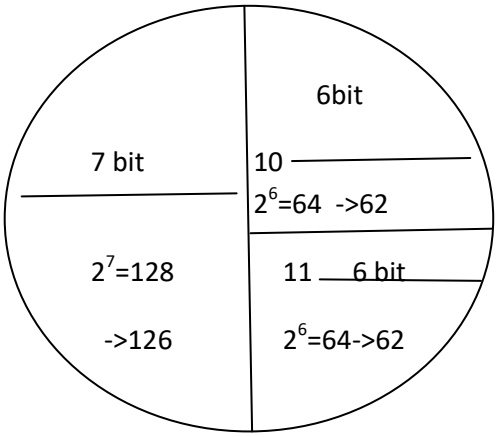
3rd Subnet	4th Subnet
IP Address of the subnet /Subnet ID= 200.1.2.128	IP Address of the subnet /Subnet ID= 200.1.2.192
Direct Broadcast Address=200.1.2.**10**111111 =200.1.2.191	Direct Broadcast Address=200.1.2.**11**111111=200.1.2.255
Total number of IP Address = 2^6=64	Total number of IP Address = 2^6=64
Range of IP Addresses= 200.1.2.128,200.1.2.191	Range of IP Addresses= 200.1.2.192,200.1.2.255
Total number of hosts that can be configured=64-2=62	Total number of hosts that can be configured=64-2=62
Range of Allocated IP Addresses=200.1.2.128 to 200.1.2.190(Real Range of IP Address)	Range of Allocated IP Addresses=200.1.2.193 to 200.1.2.254(Real Range of IP Address)
Reserved IP Addresses 200.1.2.128 and 200.1.2.191	Reserved IP Addresses 200.1.2.192 and 200.1.2.255

Variable Length Subnetting

Variable length subnetting(classless subnetting) divides the network into subnets such that:

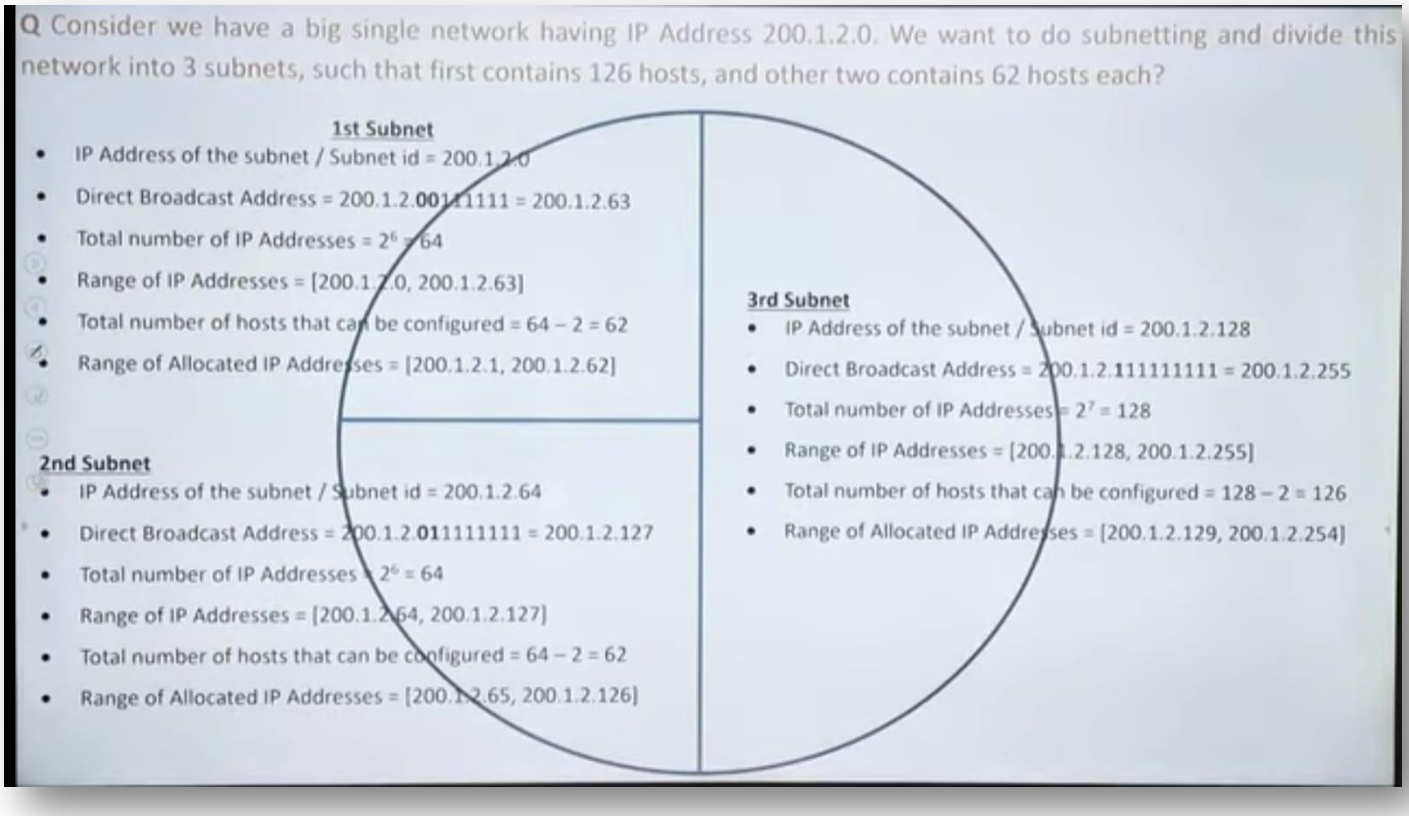
- **All the subnets are not of same size.**
- **All the subnets do not have equal numbers of hosts.**
- **All the subnets do not have same subnet mask.**

Que. 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, such that first contains 126 hosts, and other two contains 62 hosts each?



1st Subnet	2nd Subnet
IP Address of the subnet /Subnet ID= 200.1.2.0	IP Address of the subnet /Subnet ID= 200.1.2.128
Direct Broadcast Address=200.1.2.**0**1111111 =200.1.2.127	Direct Broadcast Address=200.1.2.**10**111111 =200.2.1.191
Total number of IP Address = 2^7=128	Total number of IP Address = 2^6=64
Range of IP Addresses= 200.1.2.0,200.1.2.127	Range of IP Addresses= 200.1.2.128,200.1.2.191
Total number of hosts that can be configured=128-2=126	Total number of hosts that can be configured=64-2=62
Range of Allocated IP Addresses=200.1.2.1 to 200.1.2.126(Real Range of IP Address)	Range of Allocated IP Addresses=200.1.2.129 to 200.1.2.190(Real Range of IP Address)
Reserved IP Addresses 200.1.2.0 and 200.1.2.127	Reserved IP Addresses 200.1.2.128 and 200.1.2.191

3rd Subnet
IP Address of the subnet /Subnet ID= 200.1.2.192
Direct Broadcast Address=200.1.2.**11**111111 =200.2.1.255
Total number of IP Address = 2^6=64
Range of IP Addresses= 200.1.2.193,200.1.2.255
Total number of hosts that can be configured=64-2=62
Range of Allocated IP Addresses=200.1.2.193 to 200.1.2.254(Real Range of IP Address)
Reserved IP Addresses 200.1.2.192 and 200.1.2.255



Example:

Network is 179.249.5.6 then
Network Id: 179.249.0.0
Subnet Required : 78 <=2^7(7 bit) Hosts
Subnet Mask: 11111111.11111111.11111110.0000000
255.255.254.0
1st Available Host Address: 179.249.00000000.00000001
179.249.0.1
Last Available Host Address: 179.249.00000001.11111110
179.249.1.254
Broadcast Address: 179.249.1.255
Max. No. of host: 2^9-2=51
179.249.00000000.00000001
0.1000000
0.2
0.3
0.
0.
0.256
Range [179.249.0.1 to179.249.1.254 =2^9-2=510

Note:	Net	Host
Class A: 0 to 127	8	24
Class B: 128 to 191	16	16
Class C: 192 to 223	24	8
Class D: 224 to 240	x	x
Class E: 241 to 255	x	x

In Network address always all HostId=0
In Broadcast address always all hosted=1

N	Subnet	Hosts
16	7	9

Default mask concept :
Net=1,Host=0
Subnet Mask Concept:
N,S=1,Host=0

Que. **What subnetmask would you use for 172.29.0.0 network,such that you can get 1690 subnets and 30 hosts per subnet?**

Ans: 172.29.0.0 Class B
NetId Host Id
Subnet=1690<=2^{11}=11 bits subnet
Host=30<=2^5=5 bits host

Subnet Mask Concept:
N,S=1,Host=0

11111111.11111111.11111111.11100000
Net Subnet Hosts

In Decimal
255.255.255.224
This is our subnet mask.