

1. What are the limitations of IPv4 address classes?

The limitations of IPv4 address classes are:

1. A large number of IP addresses are wasted because of using IP address classes.
2. The routing tables will become large. A separate routing table entry is needed for each network resulting in a large number of routing table entries.

2. How a large number of IP addresses are wasted using IPv4 address classes?

If a network has slightly more number of hosts than a particular class, then it needs either two IP addresses of that class or the next class of IP address. For example, let's say a network has 300 hosts, this network needs either a single class B IP address or two class C IP addresses. If class B address is allocated to this network, as the number of hosts that can be defined in a class B network is $(2^{16} - 2)$, a large number of host IP addresses are wasted. If two class C IP addresses are allocated, as the number of networks that can be defined using a class C address is only (2^{21}) , the number of available class C networks will quickly exhaust. Because of the above two reasons, a lot of IP addresses are wasted and also the available IP address space is rapidly reduced.

3. What are the possible solutions to the limitations of IP addressing?

The possible solutions to the limitation of IPv4 addressing are:

1. IP version 6 (IPv6) or IP next generation (IPng). This is the latest version of IP. This solves a lot of problems in IPv4. This document doesn't discuss about IPv6.
2. Classless Inter Domain Routing (CIDR).

4. What is CIDR?

Classless Inter Domain Routing (CIDR) is a method for assigning IP addresses without using the standard IP address classes like Class A, Class B or Class C. In CIDR, depending on the number of hosts present in a network, IP addresses are assigned.

5. Which RFCs discuss about CIDR?

RFCs 1517, 1518, and 1519 discuss about CIDR.

6. What is the difference between classful IP addressing and classless IP addressing?

The difference between classful IP addressing and classless IP addressing is in selecting the number of bits used for the network ID portion of an IP address. In classful IP addressing, the network ID portion can take only the predefined number of bits 8, 16, or 24. In classless addressing, any number of bits can be assigned to the network ID.

7. How is a network ID assigned in a CIDR IP address?

In CIDR IP addressing, the first 'n' bits of an IP address are assigned to identify the network and the remaining bits are used to identify the host, where the value of 'n' may be between 1 to 31. The value of 'n' depends on the number of hosts in the network.

8. How is an IP address represented in CIDR notation?

In CIDR notation, an IP address is represented as A.B.C.D /n, where "/n" is called the IP prefix or network prefix. The IP prefix identifies the number of significant bits used to identify a network. For example, 192.9.205.22 /18 means, the first 18 bits are used to represent the network and the remaining 14 bits are used to identify hosts.

9. What are the advantages of CIDR?

The advantages of CIDR over the classful IP addressing are:

1. CIDR can be used to effectively manage the available IP address space.
2. CIDR can reduce the number of routing table entries.

10. How CIDR can be used to effectively manage the IP address space?

Using CIDR IP addressing, any number of contiguous bits can be assigned to identify networks, depending on the number of hosts it needs to support. This will greatly reduce the number of wasted IP addresses. For example, let us say a network has 900 hosts. If classful IP addressing is used, this network needs 4 class C IP addresses or one class B IP address. If a class B IP address is used, as the maximum number of hosts in a class B network is 65534, a very large number (65534 - 900) of host IP addresses will be wasted. As the number of class C IP networks is limited (2097152), it is not preferable to assign 4 class C IP addresses to this network. On the other hand, if CIDR is used, then this network can be assigned an IP address with a network prefix of 22 (i.e. /22). This means, 10 bits are available for hosts, resulting in 1024 available host IP addresses, satisfying the exact requirements of the network. So CIDR the IP address space can be effectively used.

11. How CIDR reduces the number of entries in a routing table?

Using classful IP addressing, a separate entry is needed in the routing table of a router for each network. This results in a routing table with a large number of entries due to the existence of a large number of networks. As each router has its own limitation, this large routing table will lead to reduced performance and eventual breakdown of the router. If CIDR addressing is used, a single entry can be used to represent a group of networks. This will reduce the number of entries in the router. This is known as route aggregation. The routes for the individual networks will be present in another router down the path. Each entry in the router will have a network prefix associated with it. The network prefix is used to identify the correct network from the given IP address.

12. Will CIDR completely eliminate IP address crunch problem?

No. Even using CIDR, all the available IP addresses will get used at some point in time. The final solution to this problem is to use the next version of IP (IPv6).