Classful Addressing and Classless Addressing refer to two different approaches in the allocation and assignment of IP addresses under the Internet Protocol (IP).

### Classful Addressing:

1. \*\*Definition:\*\*

- Classful addressing was the original addressing scheme used in the early days of the Internet.

- IP addresses were divided into three main classes: A, B, and C, based on the leading bits of the IP address.

- Class A addresses had a large number of network bits and a smaller number of host bits, while Class C addresses had more host bits and fewer network bits.

2. \*\*Address Structure:\*\*

- Class A: NNNNNNNN.HHHHHHHH.HHHHHHHH.HHHHHHHH

- Class B: NNNNNNNN.NNNNNNNN.HHHHHHHH.HHHHHHHH

- Class C: NNNNNNNN.NNNNNNNN.NNNNNNNN.HHHHHHHH

3. \*\*Rigid Allocation:\*\*

- Each class had a fixed number of network and host bits, leading to inefficient use of IP address space.

- Determined by the first few bits of the IP address.

4. \*\*Subnetting:\*\*

- Subnetting was introduced later to divide a classful network into smaller subnets, but it still operated within the constraints of the original classful boundaries.

### Classless Addressing (CIDR - Classless Inter-Domain Routing):

1. \*\*Definition:\*\*

- Classless Addressing, also known as CIDR, was introduced to overcome the limitations of classful addressing.

- Allows for more flexible allocation of IP addresses without strict adherence to class boundaries.

- Addresses are expressed in the form of CIDR notation, with a prefix length indicating the number of bits used for the network portion.

2. \*\*CIDR Notation:\*\*

- Example: 192.168.1.0/24

- The "/24" indicates that the first 24 bits are used for the network, leaving 8 bits for host addresses.

- The prefix length can vary, allowing for more fine-grained control over the size of subnets.

3. \*\*Efficient Use of IP Space:\*\*

- CIDR allows for more efficient use of IP addresses by allowing the allocation of variable-sized subnets.

- Class boundaries are not strictly enforced, and networks can be subdivided based on the organization's specific needs.

4. \*\*Subnetting Flexibility:\*\*

- CIDR supports Variable Length Subnet Masking (VLSM), allowing for different subnet sizes within the same network.

5. \*\*Example:\*\*

- Instead of being confined to predefined Class A, B, or C sizes, CIDR enables the creation of subnets with custom sizes. For instance, a network could be divided into subnets with 100, 200, or any other number of hosts, based on the organization's requirements.

In summary, classful addressing had limitations in terms of inflexible allocation, which classless addressing (CIDR) addressed by introducing a more flexible and efficient approach to IP address assignment. CIDR allows for variable-sized subnets and efficient use of IP address space without being constrained by predefined classes.