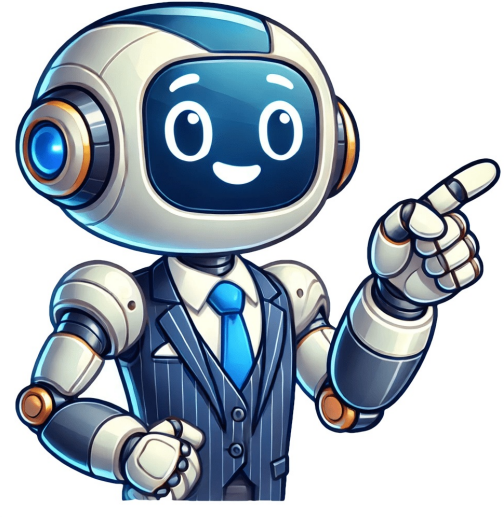


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be IP group is known as an IP subnet. We use an IP address with the subnet mask. A subnet mask separates the network address from the host address. Both an IP address and subnet mask are 32 bits in length. They arrange bits into four parts. Each part is known as an octet and contains 8 bits. Octets are separated by periods and written in a sequence. A subnet mask assigns an individual bit for each IP bit. A subnet mask can be either on or off. The value zero represents an off bit. The value one represents an on bit. An off bit represents a host bit in the IP address. As an on bit represents a network bit in the IP address. There are two popular notations to write the IP address and subnet mask: Decimal notation and Binary notation. The following table lists the relationship between subnet mask value and IP bit. Notation Subnet Mask value IP bit Decimal 1 to 255 Network Subnet Mask value IP bit Decimal 1 to 255 Network 0 192.168.1.1 255.255.0.0 0 Reserve IP classes, network, and host bits Each IP address belongs to a predefined IP class. A, B, C, D, and E. From these classes, classes D and E are reserved and cannot be used in Subnetting. In classes A, B, and C, the first 8, 16, and 24 bits are reserved for the network portion, respectively. These classes also reserve the last 8 bits for the host portion. We can not use reserve bits for subnetting. After excluding reserved network and host bits, the remaining bits are considered subnetting eligible host bits. We can use only subnetting eligible host bits for subnetting. Network address and Broadcast address Every IP network needs two specific addresses: network addresses and broadcast addresses. A network address represents the network itself, while a broadcast address represents all the hosts in the network. We can not assign these addresses to any individual host in the network. Since each IP subnet requires these two addresses, this requirement increases if we break the IP subnet into IP subnets. Network and broadcast addresses are also known as Network ID and Broadcast ID, respectively. Valid host addresses between the network and broadcast addresses are also known as valid host addresses. Any device that uses the IP protocol to transfer data needs a valid host address. We can assign only valid host addresses to end devices such as computers, laptops, tablets, smartphones, IP phones, servers, printers, terminals, IP cameras, and networking devices such as switches, routers, firewalls, and proxy servers. Block size Block size is the sum of network addresses, valid host addresses, and broadcast addresses. For example, if we have six valid host addresses, the block size will be 8 (1 network address + 6 valid host addresses + 1 broadcast address). Power of 2 An IP address is a combination of 32 binary bits. Understanding how many combinations the number of bits provides or to get the number of combinations how many bits we need is the essential step of subnetting. In an IP address, a combination of only 32 binary bits shows the complete IP address. A combination of only network bits indicates the number of IP addresses it provides in decimal. A combination of only host bits indicates the number of host addresses it provides in decimal. To know how many combinations the number of bits provides or to the number of combinations and how many bits are required, we use the power of 2. For example, to break a single IP subnet into 4 IP subnets, we need $2^2 = 4$ subnetting eligible host bits. This way, if we have 3 subnetting eligible host bits, we can make $8\ (2^3 = 8)$ additional networks. The following table lists the power of 2 to 32. 2X Value 2X Value 2X Value 2X Value 2 5 12 17 21 27 33 35 41 42 48 53 59 65 71 77 83 89 95 101 107 113 119 125 131 137 143 149 155 161 167 173 179 185 191 197 203 209 215 221 227 233 239 245 251 257 263 269 275 281 287 293 299 305 311 317 323 329 335 341 347 353 359 365 371 377 383 389 395 401 407 413 419 425 431 437 443 449 455 461 467 473 479 485 491 497 503 509 515 521 527 533 539 545 551 557 563 569 575 581 587 593 599 605 611 617 623 629 635 641 647 653 659 665 671 677 683 689 695 701 707 713 719 725 731 737 743 749 755 761 767 773 779 785 791 797 803 809 815 821 827 833 839 845 851 857 863 869 875 881 887 893 899 905 911 917 923 929 935 941 947 953 959 965 971 977 983 989 995 1001 1007 1013 1019 1025 1031 1037 1043 1049 1055 1061 1067 1073 1079 1085 1091 1097 1103 1109 1115 1121 1127 1133 1139 1145 1151 1157 1163 1169 1175 1181 1187 1193 1199 1205 1211 1217 1223 1229 1235 1241 1247 1253 1259 1265 1271 1277 1283 1289 1295 1301 1307 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