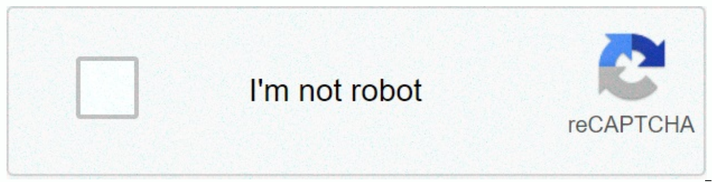


Continue

# Default subnet mask calculator

ipcalc takes an IP address and a clean mask and calculates the broadcast, the network, the resulting Cisco wildcard mask and the host range. By giving a second netmask, you can design subnets and supernets. It is also intended to be a teaching tool and presents subnet results as easy-to-understand binary values. Enter your netmask(s) in the CIDR rating (/25) or the dotted decimals (255.255.255.0). The reverse net masses are recognized. If you omit the ipcalc netmask uses the default net mask for your network class. Look at the space between the addresses bits: The bits before it is the network part of the address, the bits after it is the host party. You can see two simple facts: in a network address, all the bits of the host are zero, in a broadcast address, they are all defined. The class of your network is determined by its first bits. If your network is a private internet according to RFC 1918 this is noticed. When viewing sub-networks, new bits of the net mask network part are marked in a different color The wildcard is the reverse net mask used for access checklists in Cisco routers. Do you want to divide your network into sub-networks? Enter the address and net mask of your original network and play with the second clean mask until the result matches your needs. You can have all this fun at your shell prompt. Originally ipcalc was not intended to create HTML and still works happily in /usr/local/bin/ :-) Questions? Comments? Send me an email... Thanks for your ideas and help make this tool more useful: Bartosz Fenski Denis A. Hainsworth Foxfair Hu Frank Quotschalla Hermann J. Beckers Igor Zozulya Kevin Ivory Lars Mueller Lutz Pressler Oliver Seufer Scott Davis Steve Kent Sven Anderson Torgen Foertsch Tim Brown This page requires Javascript to be activated! All multicast addresses can easily be recognized because they start with the 1110 bit model. 224.0.0.0 - 224.0.0.255 Well-known multicast addresses, control channels 224.0.1.0 - 238,255,255.255 Addresses Multicasts at Global Reach (Internet-wide) 239.0.0.0 - 239,255,255 Local Multicast Addresses Private addresses are not routed over the Internet and can be allocated free of charge in any private network. Nat (network address translation) is required when connecting such a network to the Internet. Private network addresses (RFC1597/RFC1918 addresses): 10.0.0.0 - 10.255.255.255 A 24-bit block, /8, Class A network 172.16.0.0 - 172.31.255.255 A 20-bit block, /12, set of 16 contiguous network numbers Class B 192.168.0.0 - 192.168.255.255 A 16-bit block, /16, set of C Class C contiguous network numbers Special addresses: 127.0.0.0 - 127.255.255.255 Special address range for local time. You normally cannot use these addresses for anything else. 127.0.0.1 is usually assigned to the loopback device 0.0.0.0 Special host address usually reserved for the default route Host Mask usable Netmask Hex Mask /30 /30 2 255.255.255.252 fffffffc this is 1/64 of a Class C net /29 8 6 255.255.255.248 fffffff8 this is 1/32 of a Class C net /28 16 14 255.255.255.240 fffffff0 this is 1/16 of a Class C net /27 32 30 255.255.255.224 ffffffe0 this is 1/8 of a Class C net /26 64 62 255.255.255.192 ffffffc0 this is 1/4 of a Class C net /24 256 254 255.255.255.0 ffffff00 this is a Class C net /23 512 510 255.255.254.0 fffffe00 these are 2 Class C net /22 1024 1022 255.255.252.0 fffffc00 these are 4 Class C net /21 2048 2046 255.255.248.0 fffff800 these are 8 Class C net /20 4096 4094 255.255.240.0 fffff000 these are 16 Class C net /19 8192 8190 255.255.224.0 ffffe000 these are 32 Class C net /18 16384 16382 255.255.192.0 ffffc000 these are 64 Class C net /17 32768 32766 255.255.128.0 ffff8000 these are 128 Class C net /16 65536 65534 255.255.0.0 ffff0000 these are 256 Class C net - Class B net © Guido Socher, version 2015-12-18 This page is independent of the operating system. It only requires a capable javascript webbrowser. You can install it locally on your PC simply by saving this html page. Enter the network you want to sub-network: Click below to divide and join the sub-networks. If you want to save this sub-net for later, bookmark this hyperlink. Using this tool, you can easily generate and calculate the network class, the sub-network mask and the network node. Just follow these easy steps: 1. Enter the network address you want to generate. Example: 10.9.3.1 2. Choose which class the network address will be in. If you choose by default, it will calculate the default network class for that IP address. 3. Choose the number of sub-networks required. The default is 1 sub-network. 4. Or you can choose how many nodes per network required. Leave empty if you want to automatically generate nodes per network value. To create the subnet mask, remember first that the purpose of the subnet mask is to separate the IP address (32 bits) into the network prefix and the host number. If a little in the subnet mask is 1, the corresponding bit in the IP address is part of the network address; If the bit in the subnet mask is 0, the corresponding bit in the IP address is part of the host address. First represent the IP address in binary. For example, we have IP address: 192.168.0.1. It can be converted into binary: IP address: 1100000.10101000.00000000.0000000001 First of all, we determine what address class it is: If the first bit is 0, it's a Class A address If the first two bits are 10, it's a Class B address If the first three bits are 110 it's a Class C address If the first four bits are 1110 it's a Class D multicast address If the first four bits are 1111 it's a C-class address Class E Since the first three bits are 110, 192.168.0.1 is a Class C address. The default sub-network mask class are: Sub-network mask Class A: 111111.00000000.000000.000000.000000 0 Sub-network mask Class B: 1111111.111111.00000000.0000,000,000,000 sub-network mask Class C: C: The formula for determining the number of network bits in a sub-network mask is 2-n-number of sub-networks (2-n means 2 to the power of n) n is the number of sub-networks you want to create. For this example, we want to create 2 sub-networks. Because we want 2 sub-networks, we need to add 1 - '1' bits to the default sub-network mask from 2 to 2 to 1. This will give us the following sub-net mask: sub-network mask: 11111111.1111111.1111111.10000000 Which is mentioned to as /11111111 25 or dotted decimal notation as 255.255.255.128 [Download this tutorial] A computer network is a connection of two or more computers some form of telecommunications system. The reason for using a computer network is to share sources. We can categorize networks by many parameters. Some commonly used technologies are Ethernet, with TCP/IP protocol, for local Area Network (LAN - cover a small geographic area and provide high bandwidth with low delays) and Frame Relay for Wide Area Network (WAN). What is a sub-network? Because real networks are really big, we can't communicate directly with all computers. So we divide a network into smaller parts (hierarchically) and these parts are called sub-networks. Another reason is that we have to assign certain addresses to certain organizations. LAN is a sub-network or group of sub-networks. Network devices in an IP sub-network have a common IP address prefix. Communication between sub-networks is done by routers. Dividing a network into smaller parts is also good for performance, because emissions (packages sent to everyone) do not cross a sub-network border. Virtual LAN (VLANs) are used to have more subnets on a single switch. What is an IP address? An IP address (Internet Protocol) is a logical address for a device in a computer network using IP protocol (works on the 3rd layer of the ISO/OSI model). IP addresses are used on the Internet. IP addresses are stored as 32-bit binary numbers, but are displayed as four decimal numbers divided by a point (point-decimal notation), for example 68.12.5.10. An IP address indicates the logical location of a device. An IP address range is from 0.0.0.0 to 239.255.255.255. Public addresses are managed by the Internet Assigned Numbers Authority (IANA) and address blocks are assigned to local Internet registries. These addresses block the corresponding to geological sites. Note: I write here about the old and still being used Internet Protocol Version 4 (IPv4), there is a new version 6 of this protocol (IPv6) that uses 128 bits for address and offers many more addresses. If you want to find your computer's IP address (often a private address), you can use an ipconfig or ipconfig/all command on Windows OS or siconfig on Linux OS. IP address parts Basically, an IP address has two parts, a network identification prefix followed by a host address within that network. During the evolution of the IP sub-network, there have been many changes. It with a class networking, where a network prefix was firmly made by an IP address (and its class). Through classless networking, where we can take part of a host number from a class and use that part as a sub-network number. Thus, we can divide a class into more than one sub-network with a lower number of hosts. Until today's sub-sure, which uses cidr, where we use arbitrary network prefixes. Note: Although the use of the CIDR is common to divide an IP address into 3 parts, where network numbers are made by class (even if we use a classless network), one sub-network number is separated from that class, and the rest is a host party. This is important when we calculate a number of sub-networks. classful 'network-prefix' -------host-number--------- network-number-the-network-number addresses-------- ------- are an important part of ip ip addresses without a class IP addresses IP addresses. These addresses are used on the Internet or other WAN (Wide Area Network) and could be routed through these networks. Private IP Addresses Private IP addresses are used on a LOCAL Area Network (LAN) and if you wish to communicate on the Internet, you must translate this address to a public IP address. A common solution for address translation is NAT (Network Address Translation). We use private IP addresses to save the number of public IP addresses. networknetwork IDbroadcast addresses class 10.0.0/810.0.0.010.255.255.25510.0.0.1 - 1 0.255 .255.254 Class A 172.16.0.0/12 172.16.0.0 172.31.255.255 172.0.0.0.0 0172.16.0.1 - 172.31.255.254 Class B 192.168.0/16192.168.0.0192.0192.0 168.255.255192.168.0.1 - 192.168.255,254 Special Class C IP addresses We also have some IP address ranges with special meanings. networknetwork IDbroadcast address name 0.0.0.0/32 default network ID (zero) 0.0.0.0/8 0.0.0 0 0.255.255 zero addresses 127.0.0/8127.0.0.0.0.0.0.0.0.0 0.0127.255.255.255 addresses loopback localhost 169.254.0/16 169.254.0.0 169.254.255.255 addresses zeroconf (APIPA) 192.0.2.2.2.2 192.0 192.0 192.0.2.255 documentation and examples 192.18.18.0/23 192.18.18.0 192.18.19.255 network device benchmark 192.18.258.2585192.88.99.0/24 192.88.99.0 192.88.99.255 IPv6 to IPv4 relay Anycast Anycast 224.0.0/4 multicast address ID network The first IP address of a sub-network cannot be assigned to the host. This address identifies the sub-network, it is called a network ID (or basic address or network address). This address has only zeros in the host part. Broadcast Address The last IP address of a sub-network cannot be assigned to but it is a subnet broadcast address. This address is used for a directed sub-network broadcast, it is a message that is sent to all hosts of this sub-network. This address has only one in the host part. A sub-network-led broadcast is routed through the network like a unicast, until it reaches the last hop router, and here it is sent as a full broadcast to that sub-network. A full-right/host-number ---------- 'lt;/host-number;/subnet-number;/network-number--------/-------- ------- network-prefi -------x address has only those in all bytes, it is 255.255.255.255. Note: We have 3 types of communication (sending data). The first is a unicast, when a host sends a message to another host. A broadcast, when a host sends a message to either all hosts (normally works for all hosts in the same sub-network) or to all hosts in a specific sub-network. And the last method is a multicast, when a host sends a message to a specific group of other hosts. Host Address All other addresses in a sub-network are host addresses. These addresses can be assigned to network devices such as the computer. Here is an example of the appearance of addresses in sub-network 192.168.5.12/30. Mask /30 is binary 1111111.111111111.111111.111111.1111100. Address binary IP address 192.168.5.12 11000000.10101000.0000101.0001100 Network ID 192.168.5.13 1100000.10000.10 101000.0000101.000011101 host address 1192.168.5.14 1100000.101000.0000101.00011110 host address 192.. 168.5.15 1100000.10101000.0000101.000011111 broadcast address What is a sub-network mask? Subnet mask tell us which part of an address is a network part and which is a host party. The network part refers to a sub-network and is used for routing to that sub-network. The host party designates all members of this sub-network and is only useful in this sub-network. Subnet mask in IPv4 consist of 32 bits and is normally represented using the dot-decimal form. Valid mask has those on the left side followed by zeros (after the first zero can only be zero). Example of a sub-network mask is 255.255.255.0. Review: Subnet Mask 255.255.255.254 is not allowed because it has a 0 possible hosts (it is possible to use this mask for some special point-to-point links). Mask 255.255.255.255 addresses not a sub-network, but a host. Next table show details on all sub-network masks. CIDR decimal number of addresses classful subnets /1 128.0.0.0 2147483646 128 A 2 /2 192.0.0.0 1073741822 64 A 4 /3 224.0.0.0 536870910 32 A 8 /4 240.0.0.0 268435454 16 A 16 /5 248.0.0.0 134217726 8 A 32 /6 252.0.0.0 67108862 4 A 64 /7 254.0.0.0 33554430 2 A 128 /8 255.0.0.0 16777214 1 A 256 /9 255.128.0.0 8388606 128 B 512 /10 255.192.0.0 4194302 64 B 1024 /11 255.224.0.0 2097150 32 B 2048 /12 255.240.0.0 1048574 16 B 4096 /13 255.248.0.0 524286 8 B 8192 /14 255.252.0.0 262142 4 B 16384 /15 255.254.0.0 131070 2 B 32768 /16 255.255.0.0 65534 1 B 65536 /17 255.255.128.0 32766 128 C 131072 /18 255.255.192.0 16382 64 C 262144 /19 255.255.224.0 8190 32 C 524288 /20 255.255.240.0 4094 16 C 1048576 /21 255.255.248.0 2046 8 C 2097152 /22 255.255.252.0 1022 4 C 4194304 /23 255.255.254.0 510 2 C 8388608 /24 255.255.255.0 254 1 C 16777216 /25 255.255.255.128 126 1/2 C /26 255.255.255.192 62 1/4 C 67108864 /27 255.255.255.224 1/224 1/208 C 134217728 /28 2 55.255.255.240 14 1/16 C 268435456 /29 255.255.255.255.248 6 1/32 C 536870912 /30 255.255.255.252 2 1/64 C 1073741824 /0 31 255.255.255.254 0 1/128 C /32 255.255.255 1 CIDR A shorter and more to represent a subnet mask is a classless inter-domain routing form (CIDR). This is an IP address followed by a slash (/) and the number of one bits in the binary notation of the subnet mask (or only /number of bits). For example, we have an IP address 192.168.100.25 with a sub-network mask 255.255.255.240, Binary form of this mask is 1111111.11111111.1111111.11110000, so a CIDR representation is 192.168.100.25/28. Note: The CIDR is not only a representation form, but also provides certain mechanisms such as VLSM, aggregation and more. Vlsm Variable Length Subnet Mask (VLSM) is a technique on which THE CIDR is based. It allows allocation on prefixes of arbitrary length, it uses classless routing. Wildcard Mask For some special applications (e.g. the Cisco IOS access list), there is an inverse form of sub-network mask called a wildcard mask. We can do negation functions on a binary representation of a sub-net mask, or take each decimal byte and calculate 255 - byte. For example, sub-network mask 255.255.255.240 has wildcard mask 0.0.0.15. Classful Network Older versions of the Internet protocol have divided IP addresses into 5 classes, all of which define a sub-network mask. Class division is done by the first bits of an IP address. A sub-network mask is not sent with an IP address during communication, as it is determined by IP address. classsignificant bitsaddress rangemaskCIDR mask note class A 0xxx0 - 127.x.x.x.x255.0.0.0.0/8 general class B 10xx128 - 191.x.x.x.x255.0.0/16 general class C 1128 223.x.x.x255.255.255.0/24 General Class D1110224 - 239.x.x.x.x.x.x multicast class E1111240 - 255.x.x.x networkless class booked Soon, after greater use of the Internet, it has become clear that classful network design is inefficient and non-evolving. Thus, a new network design was developed using VLSM and CIDR. This is called a classless network. It allowed the division of classes into small sub-networks. Supernet - VLSM and CIDR aggregation allow us to use an aggregation of multiple contiguous subnets into a single supernet. Supernets save space and resources during the routing process. If we have two subnets 192.168.0.0/24 and 192.168.1.0/24, the supernet is 192.168.0.0/23. Calculation Maximum Hosts and Sub-Networks The maximum number of hosts and sub-networks in a particular sub-network is designated by a sub-network mask. A sub-network mask divides an IP address into part network and host part by a number of a few and zeroes. So we translate a sub-network mask into binary form, or we can use a mask and count the number of ones and zeros (number of zeroes - 32 - number of a few). The network part of an address is designated by those in the subnet mask, which means that we can change bits in that part and whenever we have a different subnet, so the number of combinations in that part is the number of subnets. But the number of sub-networks depends on the architecture we use (I mentioned this in the chapter IP parties). If we use a CIDR, we can use the entire network prefix, that is how I understand modern sub-networking. We can count the number of sub-networks using the following equation. 2number-of-ones - number of sub-networks Note: This is a new version to count the number of a sub-network following RFC 1812. In the past, we have used RFC 950 and we have had to subtract 2 from this number (for all those and all zero addresses). I often encounter a situation where people think of a number of sub-networks in a different way. I think that is okay for older networks, where we do not

use the CIDR. Here we have to find an IP address class and count the number of sub-networks only in that class. 2number-of-ones-in-mask - number-of-ones-in-class - number-of-subnets Example: We have an address 148.25.3.5/22 because of CIDR we know that a number of those in the subnet mask is 22 and the number of zeroes is 2232 - 22 - 10 1) some of the sub-networks for the first situation - 222 - 4 194 304 2) but for the second situation, we have to take an IP address and by first bits find that it is a class B (mask /16) so that a number of sub-networks - 222-16 - 26 - 64 Number of hosts is an easier and similar principle. The host part of an address is designated by zeros in the subnet mask. We had to subtract 1 for the network id and 1 for the broadcast address. 2number-of-zeros - 2 - number of hosts Example: We have an address 148.25.3.5/22 number of hosts - 2 - 2 - 1024 - 2 - 1022 Are two hosts of the same sub-network? We have two IP addresses with a sub-network mask and we want to know if they come from the same sub-network. First of all, the mask should be the same. Then we translate an IP address and a sub-network mask into binary form. If the part, where in the subnet mask are those, is the same in both IP addresses, they belong to the same subnet. Example: IP Address 1: 192.168.5.13/22, IP address 2: 192.168.7.128/22 1) sub-network masks are the same 2) IP 1: 1100000.10101000101.000001.000001.00000 01101 IP 2 binary: 11000000.1010100.0000111.1000000000 sub-network mask: 1111111111111.11111111100.0000000000 3) the network part of the two addresses are the same, so they belong to the same iD network sub-network from a host IP address and a sub-network mask, we can calculate a network iD. We need to translate an IP address and a sub-network mask into binary form and after that we'll do a little ANDwise. Example: IP address: 10.217.123.7/20 Binary IP: 00001010.1101101.0111011.0001111 binary mask: 11111111111.11111000.00000 decimals: 10.217.112.0 Another way to describe this is, that we engitimize the network part of an IP address and that the host party fills up with zeroes. Subnet Broadcast Address Again from an IP address and a sub-network mask, we can calculate a broadcast address. We need to translate an IP address and a sub-network mask into binary form and after we do a little wise OR between an IP address and a denial mask, broadcast address - IP ADDRESS OR OR Example: IP Address: 10.217.123.7/20 Binary IP: 00001010.1101001.0111011.0000 Binary Mask 1111111.1111111.11111.111000.000,000,000,000,000 negation mask: 00000000.. 0000000.00001111.111111 bitwise OR: 00001010.1101001.0111111.1111111 decimal place: 10.217.127.255 Another way to describe this is, that we would have the network part of an IP address and the host party fills up with those. Information Sources RFC 917 RFC 950 RFC 1812 RFC 1878 RFC 3021 3021