

Given The Ip Address Of 199.1.1.100 And The Mask Of 255.255.255.224, Calculate The Subnet Number, Broadcast

Given The Ip Address Of 199.1.1.100 And The Mask Of 255.255.255.224, Calculate The Subnet Number, Broadcast is a fundamental task in networking that involves understanding subnetting concepts. Subnetting allows network administrators to divide a larger network into smaller, manageable segments, improving security, performance, and organization. To accurately determine the subnet number and broadcast address for a given IP address and subnet mask, one must understand the binary representations of these values and how subnetting works in IPv4 networks.

In this comprehensive guide, we will explore the process step by step, covering key concepts, calculations, and practical examples to help you master subnetting calculations for any network.

Understanding IP Addressing and Subnet Masks

Before diving into calculations, it's essential to understand what an IP address and subnet mask represent.

What is an IP Address?

An IP address is a 32-bit numeric address assigned to devices on a network. It uniquely identifies each device and enables communication across networks. IPv4 addresses are expressed in dotted-decimal notation, consisting of four octets (8 bits each), separated by periods. For example, 199.1.1.100.

What is a Subnet Mask?

A subnet mask determines the network and host portions of an IP address. It is also expressed in dotted-decimal notation. The mask 255.255.255.224 indicates which bits are used for network addressing and which are for hosts within that network.

Binary Representation

To perform subnet calculations, converting both the IP address and subnet mask to binary is essential. Each octet is represented by 8 bits:

- 255.255.255.224 in binary:
- 255 = 11111111
- 255 = 11111111
- 255 = 11111111
- 224 = 11100000

Understanding binary helps to identify network and host bits.

Step-by-Step Calculation of Subnet Number and Broadcast Address

Now, let's proceed with the calculation based on the provided details:

- IP Address: 199.1.1.100
- Subnet Mask: 255.255.255.224

Step 1: Convert IP Address and Subnet Mask to Binary

	Octet	IP Address	Binary	Subnet Mask	Binary
	1	199	11000111	255	11111111
	2	1	00000001	255	11111111
	3	1	00000001	255	11111111
	4	100	01100100	224	11100000

Step 2: Identify Network and Host Bits

The subnet mask 255.255.255.224 indicates:

- The first 27 bits are for the network portion:
- 255.255.255.224 in binary: 11111111.11111111.11111111.11100000
- The last 5 bits are for hosts within the subnet.

This means that in the last octet:

- Bits 1-3 are network bits (all set to 1)
- Bits 4-8 are host bits (the last 5 bits)

Step 3: Calculate the Subnet Block Size

The block size is determined by the bits used for hosts:

- The mask 224 in decimal corresponds to $2^3 = 8$.
- The block size (increment) is 32 (since $256 - 224 = 32$).

This means each subnet increases in blocks of 32 in the last octet.

Step 4: Determine the Subnet Number (Network Address)

To find the subnet address, identify the network portion of the IP address and set all host bits to zero.

- The IP address in the last octet is 100.
- Since the block size is 32, find the nearest lower multiple of 32:

$$100 \div 32 = 3.125 \rightarrow \text{floor} = 3$$

- Subnet network address in the last octet is:

$$3 \times 32 = 96$$

- Therefore, the subnet number (network address) is:

199.1.1.96

The network address (subnet number) is 199.1.1.96.

Step 5: Calculate the Broadcast Address

The broadcast address is the last address in the subnet, where all host bits are set to 1.

- Since the subnet starts at 199.1.1.96, the broadcast address is:

$$199.1.1.(96 + 31) = 199.1.1.127$$

- Explanation:

- The host bits are the last 5 bits.

- The maximum value for host bits is $2^5 - 1 = 31$.

- Adding 31 to the network address gives the broadcast address.

Thus, the broadcast address is 199.1.1.127.

Summary of Calculations

Parameter	Value
Subnet Number (Network Address)	199.1.1.96
Broadcast Address	199.1.1.127
Usable IP Range	199.1.1.97 to 199.1.1.126
Subnet Mask	255.255.255.224

Note: The usable IP addresses within this subnet are those between the network address and the broadcast address, excluding both.

Understanding the Significance of These Calculations

Subnetting calculations like the ones above are vital for network design, management, and troubleshooting. Knowing the subnet address and broadcast address allows network administrators to:

- Assign IP addresses efficiently within each subnet.

- Configure routers and switches accurately.
- Prevent IP address conflicts.
- Improve network security by isolating segments.
- Optimize network performance by limiting broadcast domains.

Practical Applications of Subnetting

Understanding how to calculate subnet network and broadcast addresses is essential in various real-world scenarios:

- Designing a new network: Determine appropriate subnet sizes based on device requirements.
- Troubleshooting network issues: Identify incorrect IP configurations.
- Implementing VLANs: Segregate traffic logically within a physical network.
- Managing IP address space: Efficiently allocate addresses in large organizations.

Conclusion

Calculating the subnet number and broadcast address for a given IP address and subnet mask is a fundamental skill in network administration. By converting IP addresses and masks to binary, understanding subnetting principles, and applying block size calculations, one can accurately determine network boundaries and broadcast addresses. This knowledge not only enhances network design and management but also contributes to more secure and efficient network operations.

Remember that practice is key. Use different IP addresses and subnet masks to reinforce your understanding and become proficient in subnetting calculations.

Frequently Asked Questions

How do I calculate the subnet number for IP 199.1.1.100 with mask 255.255.255.224?

Convert the IP and subnet mask to binary, perform a bitwise AND operation between them, and the result is the subnet number. For 199.1.1.100/27, the subnet number is 199.1.1.96.

What is the broadcast address for IP 199.1.1.100 with subnet mask 255.255.255.224?

The broadcast address is obtained by setting all host bits to 1. For this subnet, the broadcast address is 199.1.1.127.

How many hosts are available in the subnet 199.1.1.96/27?

With a /27 subnet mask, there are 32 IP addresses total, but 30 usable hosts (excluding network and broadcast addresses).

What is the significance of the subnet mask 255.255.255.224 in IP addressing?

This subnet mask indicates a 27-bit network prefix, allowing for 32 addresses per subnet, suitable for small networks or segments.

How do I verify if 199.1.1.100 belongs to the subnet 199.1.1.96/27?

Perform a bitwise AND between the IP and subnet mask to get the subnet number. Since it matches 199.1.1.96, the IP belongs to that subnet.

What is the range of host addresses available in the subnet 199.1.1.96/27?

The usable host addresses range from 199.1.1.97 to 199.1.1.126, with 199.1.1.127 as the broadcast address.

Can 199.1.1.100 be assigned to a device in this subnet?

Yes, since 199.1.1.100 is within the range 199.1.1.97 to 199.1.1.126, it can be assigned to a device in this subnet.

Additional Resources

Given The IP Address Of 199.1.1.100 And The Mask Of 255.255.255.224, Calculate The Subnet Number, Broadcast — this is a common task in networking that involves understanding subnetting, an essential concept for efficient IP address management and network design. Whether you are a network administrator, a student learning about networking, or an IT professional, mastering how to calculate subnet numbers and broadcast addresses based on IP addresses and subnet masks is fundamental. In this comprehensive guide, we will walk through the step-by-step process of analyzing the given IP address and subnet mask, calculating the subnet number, and determining the broadcast address, providing clarity and practical insight.

Understanding the Basics: IP Address and Subnet Mask

Before diving into calculations, it's important to understand the basic components involved:

- IP Address (199.1.1.100): A unique identifier assigned to a device within a network.
- Subnet Mask (255.255.255.224): Defines the network and host portions of the IP address, allowing

the division of a larger network into smaller subnetworks.

What is an IP Address?

An IPv4 address consists of four octets (8-bit numbers), typically written in decimal form separated by dots (e.g., 199.1.1.100). It belongs to a class based on its first octet, but with subnetting, class distinctions are often less rigid.

What is a Subnet Mask?

The subnet mask determines which part of the IP address refers to the network and which part refers to the host. In dotted decimal notation, 255.255.255.224 indicates that the first 27 bits are network bits, and the last 5 bits are host bits.

Step 1: Convert IP Address and Subnet Mask to Binary

The first step in subnetting calculations is to convert both the IP address and subnet mask to binary.

IP Address in Binary:

Octet	Decimal	Binary
-----	-----	-----
1	199	11000111
2	1	00000001
3	1	00000001
4	100	01100100

Subnet Mask in Binary:

Octet	Decimal	Binary
-----	-----	-----
1	255	11111111
2	255	11111111
3	255	11111111
4	224	11100000

Step 2: Determine the Network Bits and Host Bits

The subnet mask 255.255.255.224 indicates:

- First 3 octets: 255 (all bits are network bits)
- Fourth octet: 224 (binary 11100000)

The number of bits set to 1 in the mask is:

- $8 + 8 + 8 + 3 = 27$ bits

This means the network portion is 27 bits, and the remaining 5 bits are for hosts.

Step 3: Calculate the Subnet Number

The subnet number (or network address) is obtained by performing a logical AND operation between the IP address and the subnet mask.

Performing AND Operation:

For each octet, perform:

`Network Octet = IP Octet AND Subnet Mask Octet`

Octet	IP Octet	Mask Octet	AND Result	Binary Result	Decimal Result
-----	-----	-----	-----	-----	-----
1	199	255	199	11000111 AND 11111111	199
2	1	255	1	00000001 AND 11111111	1
3	1	255	1	00000001 AND 11111111	1
4	100	224	96	01100100 AND 11100000	96

Subnet Number: 199.1.1.96

This is the address of the subnet that contains 199.1.1.100.

Step 4: Calculate the Broadcast Address

The broadcast address is the last address in the subnet, used to communicate with all hosts within that subnet.

Method:

- Set all host bits (the bits after the network bits) to 1.

Since the network mask has 27 bits for network, the last 5 bits are host bits.

Find the Block Size:

- The block size for the last octet is calculated as:

`256 - Subnet Mask Octet`

For 224:

`256 - 224 = 32`

This indicates that subnets increment by 32 in the last octet.

Determine the Broadcast Address:

- The subnet starts at 199.1.1.96 (the subnet number).
- The broadcast address is the last address in the subnet, which is:

`Subnet Number + Block Size - 1`

Calculating:

`96 + 32 - 1 = 127`

Broadcast Address: 199.1.1.127

This address is used to broadcast messages to all hosts within the subnet.

Summary of Calculations

Parameter	Value
Subnet Number	199.1.1.96
Broadcast Address	199.1.1.127
Subnet Mask	255.255.255.224
Network Bits	27
Host Bits	5
Number of Hosts per Subnet	$2^5 - 2 = 30$ (usable addresses)

Practical Insights and Applications

Understanding how to calculate the subnet number and broadcast address helps network administrators design scalable, efficient networks. Some practical considerations include:

- Network Planning: Knowing the subnet allows for optimal IP address allocation, avoiding wastage.
- Routing Efficiency: Accurate subnetting reduces routing table size and improves network performance.
- Security: Subnetting can isolate segments for security purposes.
- Troubleshooting: Identifying subnet boundaries helps isolate network issues.

Additional Tips for Subnetting

- Always convert IP addresses and masks to binary for clarity.
- Use subnet calculators for complex or large networks, but understand manual calculations.
- Remember that the first address in a subnet is the subnet number, and the last is the broadcast address; these are typically reserved.
- The usable host addresses are between the subnet number +1 and broadcast -1.

Conclusion

Given The IP Address Of 199.1.1.100 And The Mask Of 255.255.255.224, Calculate The Subnet Number, Broadcast is a fundamental exercise that exemplifies core networking skills. By systematically converting to binary, performing bitwise operations, and understanding subnetting principles, you can accurately determine network boundaries and optimize network design. Mastery of these calculations enhances your ability to configure, troubleshoot, and manage IP networks efficiently.

Understanding subnetting not only improves your technical proficiency but also provides a solid foundation for advanced networking concepts like VLANs, CIDR, and route summarization. Keep practicing with different IP addresses and masks to strengthen your skills and become confident in network planning and management.

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