An Organization Is Granted The Block 211.17.180.0/24. The Administrator Wants To Create 32 Subnets. A.

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When an organization receives a large block of IP addresses, such as 211.17.180.0/24, network administrators often need to subdivide this block into smaller subnets to better organize and secure their network infrastructure. Creating 32 subnets from a single Class C network involves understanding subnetting principles, calculating subnet masks, and designing an efficient IP addressing scheme. This article provides a comprehensive guide on how to achieve this, highlighting key concepts, step-by-step calculations, and practical considerations.

Understanding the Basics of Subnetting

What Is Subnetting?

Subnetting is the process of dividing a larger IP network into smaller, manageable segments called subnets. It enhances network performance, improves security, and simplifies management by isolating traffic within specific segments.

Why Subnet?

- Efficient IP Address Utilization: Prevent IP wastage by allocating addresses based on actual needs.
- Security: Isolate sensitive data within specific subnets.
- Performance: Reduce broadcast domains, limiting broadcast traffic.
- Simplified Management: Easier troubleshooting and network segmentation.

Key Concepts in Subnetting

- Network Prefix: The part of the IP address that indicates the network.
- Host Portion: The part of the IP address used for individual devices.
- Subnet Mask: Determines the boundary between network and host portions.
- CIDR Notation: Classless Inter-Domain Routing notation, e.g., /24.

Analyzing the Given IP Block: 211.17.180.0/24

Class and Default Subnet Mask

The IP address 211.17.180.0 belongs to Class C, which has a default subnet mask of 255.255.255.0 (/24). This means:
- Network bits: 24
- Host bits: 8
- Total addresses: 2^8 = 256
- Usable addresses: 254 (addresses from 211.17.180.1 to 211.17.180.254)

Objective: Creating 32 Subnets

The goal is to subdivide this /24 network into 32 smaller subnets. This involves borrowing bits from the host portion to create additional network bits.

Calculating the Subnet Mask for 32 Subnets

How Many Bits to Borrow?

To determine the number of bits to borrow:
- Use the formula: 2^n ≥ Number of subnets
- For 32 subnets: 2^n ≥ 32
- n = 5 (since 2^5 = 32)

Resulting Subnet Mask

- Original mask: /24 (255.255.255.0)
- Borrow 5 bits from the host portion:
- New mask: /24 + 5 = /29
- Subnet mask in decimal: 255.255.255.248

Summary of Subnet Mask

CIDR Notation	Subnet Mask	Number of Subnets	Hosts per Subnet
/29	255.255.255.248	32	6 usable addresses

Note: Each /29 subnet has 8 addresses, but 2 addresses are reserved (network and broadcast), leaving 6 usable addresses per subnet.

Designing the Subnets

Subnet Addressing Scheme

Starting with the base network 211.17.180.0/24, the subnets will increment by 8 addresses (since /29 mask adds 3 bits to the host part, each subnet covers 8 addresses).

The subnets are as follows:

1. 211.17.180.0/29 (Addresses: 211.17.180.0 - 211.17.180.7)
2. 211.17.180.8/29 (Addresses: 211.17.180.8 - 211.17.180.15)
3. 211.17.180.16/29 (Addresses: 211.17.180.16 - 211.17.180.23)
4. 211.17.180.24/29 (Addresses: 211.17.180.24 - 211.17.180.31)

... and so forth, up to the 32nd subnet.

Calculating the Subnet Addresses

- Each subnet increases by 8 in the last octet.
- The pattern continues: 211.17.180.0, 211.17.180.8, 211.17.180.16, ..., 211.17.180.248.

Practical Implementation and Usage

Assigning Subnets to Departments or Locations

- Subnets can be allocated based on physical locations, departments, or functional groups.
- For example:
- 211.17.180.0/29 for the main office.
- 211.17.180.8/29 for the branch office.
- 211.17.180.16/29 for data centers, etc.

Routing Considerations

- Proper routing protocols (such as OSPF, EIGRP, or static routes) should be configured to manage traffic between subnets.
- Ensure that the network infrastructure supports the required subnetting scheme.

Address Planning Tips

- Reserve some subnets for future expansion.
- Maintain documentation of subnet allocations.
- Use consistent subnetting schemes for clarity.

Additional Considerations

Broadcast and Network Addresses

- Each subnet has:
- Network address: First address (e.g., 211.17.180.0)
- Broadcast address: Last address (e.g., 211.17.180.7)
- These addresses are reserved and should not be assigned to hosts.

Usable Host Addresses

- For each subnet, usable IPs are from the second address to the penultimate.
- For example, in 211.17.180.0/29:
- Usable addresses: 211.17.180.1 - 211.17.180.6

Limitations and Best Practices

- Avoid creating too many subnets if not necessary, to prevent routing complexity.
- Use hierarchical addressing schemes for scalability.
- Consider future growth when designing subnets.

Conclusion

Creating 32 subnets from the 211.17.180.0/24 network involves understanding subnetting fundamentals, calculating the appropriate subnet mask, and planning the network layout accordingly. By borrowing 5 bits from the host portion, the administrator can generate exactly 32 subnets, each with 6 usable IP addresses. This approach ensures efficient IP address utilization, network segmentation, and facilitates better management and security.

Proper planning, documentation, and adherence to best practices are essential for implementing an effective subnetting scheme. Whether for small departmental networks or larger organizational segments, subnetting provides the flexibility and scalability needed to support evolving network demands.

Keywords: subnetting, CIDR, IP addressing, network segmentation, IP subnet mask, 211.17.180.0/24, 32 subnets, network design, routing, IP management

Frequently Asked Questions

How many bits are required to create 32 subnets from the original /24 network 211.17.180.0/24?

To create 32 subnets, 5 additional bits are needed since 2^5 = 32, resulting in a new subnet mask of /29.

What is the subnet mask when dividing the 211.17.180.0/24 network into 32 subnets?

The subnet mask becomes 255.255.255.248 or /29, as it adds 5 bits for subnetting.

How many IP addresses are available in each subnet after subnetting 211.17.180.0/24 into 32 subnets?

Each /29 subnet has 8 IP addresses, but typically 6 are usable for hosts, since 1 is network and 1 is broadcast address.

What are the range of IP addresses in the first subnet created from 211.17.180.0/24?

The first subnet (211.17.180.0/29) ranges from 211.17.180.1 to 211.17.180.6, with network address 211.17.180.0 and broadcast address 211.17.180.7.

How do you calculate the new subnet addresses after dividing 211.17.180.0/24 into 32 subnets?

Increment the network portion by 8 in the last octet (since /29), starting from 211.17.180.0, to generate subnet addresses.

What is the significance of the /29 subnet mask in network segmentation?

A /29 subnet mask allows for 6 usable host IPs per subnet, enabling efficient segmentation for small network groups.

What considerations should be made when subnetting

211.17.180.0/24 into 32 subnets?

Ensure that each subnet has enough IP addresses for hosts, and check for broadcast and network addresses to avoid conflicts.

How does subnetting into 32 subnets impact network management and routing?

Subnetting simplifies management and improves routing efficiency by isolating broadcast domains, but increases the complexity of routing tables.

Can the existing network 211.17.180.0/24 support creating 32 subnets without additional IP space?

Yes, because dividing a /24 into 32 /29 subnets is feasible within the existing IP range, as it only requires subnetting the current network.

What tools or commands can be used to verify subnetting and IP address ranges for 211.17.180.0/24?

Tools like subnet calculators, IP address planners, or commands such as 'ipcalc' and 'subnetcalc' can help verify subnet ranges and configurations.

Additional Resources

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In the realm of network management, the efficient subdivision of IP address space is fundamental to ensuring scalable, secure, and manageable network infrastructures. When an organization is granted a block such as 211.17.180.0/24, it signifies they have been allocated a specific range of IPv4 addresses—specifically, 256 addresses (from 211.17.180.0 to 211.17.180.255). The administrator’s goal to subdivide this block into 32 smaller subnets underscores a common scenario faced by network engineers: balancing the need for adequate address space with the necessity of organized, logical segmentation. This article offers a comprehensive exploration of the technical considerations, methodologies, and implications involved in creating 32 subnets from a /24 network, with detailed explanations to inform both novice and seasoned network professionals.

Understanding the Basics: CIDR and Subnetting Concepts

Classless Inter-Domain Routing (CIDR) and Its Significance

Classless Inter-Domain Routing (CIDR) revolutionized IP address assignment by allowing flexible allocation of address blocks, moving away from rigid class-based divisions. CIDR notation, such as /24, indicates the number of bits used for the network prefix. In this context, 211.17.180.0/24 means the first 24 bits are designated for network identification, leaving 8 bits for host addresses within that network.

Subnetting Explained

Subnetting is the process of dividing a larger network into smaller, manageable sub-networks or subnets. It involves borrowing bits from the host portion of the address to extend the network prefix, thereby creating multiple subnetworks with their own address ranges. Proper subnetting facilitates:

- Improved network management
- Enhanced security through segmentation
- Efficient utilization of IP address space
- Simplified routing

In this scenario, the administrator aims to create 32 subnets, which necessitates a strategic extension of the network prefix.

Calculating the Subnet Requirements

Determining the Number of Bits to Borrow

To create 32 subnets from a /24 network, we need to determine the number of bits to borrow from the host portion to generate sufficient subnet addresses.

- Number of subnets desired: 32
- The number of bits needed: $2^n \geq 32$

Calculating n:
- $2^4 = 16$ (not enough)
- $2^5 = 32$ (meets the requirement)

Thus, borrowing 5 bits from the host portion provides exactly 32 subnets.

Revised Subnet Mask

Original mask: /24 (255.255.255.0)

- Borrowing 5 bits from the host part (which originally had 8 bits)
- New subnet mask: /24 + 5 = /29

Expressed in dotted decimal:
- /29 corresponds to 255.255.255.248

This mask indicates:

- Network prefix: 29 bits
- Host bits: 3 bits (since 32 - 29 = 3)

Number of addresses per subnet:
- Total addresses: $2^{3} = 8$
- Usable addresses per subnet: 6 (excluding network and broadcast addresses)

Subnetting the 211.17.180.0/24 Network

Breaking Down the Address Space

With a /29 subnet mask, the original /24 network divides into multiple smaller subnets, each with 8 addresses.

The subnets will increment by 8 in the last octet:
- 211.17.180.0/29
- 211.17.180.8/29
- 211.17.180.16/29
- 211.17.180.24/29
- … and so forth, up to the last subnet.

Since 256 addresses are available, dividing by 8 yields:
- $256 / 8 = 32$ subnets

This perfectly aligns with the administrator’s goal.

Listing the Subnets

The subnets are:
1. 211.17.180.0/29

2. 211.17.180.8/29
3. 211.17.180.16/29
4. 211.17.180.24/29
5. 211.17.180.32/29
6. 211.17.180.40/29
7. 211.17.180.48/29
8. 211.17.180.56/29
9. 211.17.180.64/29
10. 211.17.180.72/29
11. 211.17.180.80/29
12. 211.17.180.88/29
13. 211.17.180.96/29
14. 211.17.180.104/29
15. 211.17.180.112/29
16. 211.17.180.120/29
17. 211.17.180.128/29
18. 211.17.180.136/29
19. 211.17.180.144/29
20. 211.17.180.152/29
21. 211.17.180.160/29
22. 211.17.180.168/29
23. 211.17.180.176/29
24. 211.17.180.184/29
25. 211.17.180.192/29
26. 211.17.180.200/29
27. 211.17.180.208/29
28. 211.17.180.216/29
29. 211.17.180.224/29
30. 211.17.180.232/29
31. 211.17.180.240/29
32. 211.17.180.248/29

Implications of Subnetting for Network Management

Advantages of Creating Multiple /29 Subnets

- Isolation and Security: Each subnet can host different departments or functions, limiting broadcast domains and enhancing security.
- Simplified Troubleshooting: Smaller subnets make it easier to isolate network issues.
- Efficient Address Utilization: Using /29 subnets ensures minimal wastage of IP addresses while providing enough hosts per subnet.
- Scalability: Future expansion can be managed by allocating additional subnets within the same address space.

Limitations and Considerations

- Limited Hosts per Subnet: With only 6 usable addresses, /29 subnets are suitable for small segments like servers, switches, or point-to-point links, but not for large departmental networks.
- Broadcast Traffic: Smaller subnets reduce broadcast traffic, improving overall network performance.
- Routing Complexity: Managing multiple subnets requires an efficient routing strategy, potentially increasing configuration complexity.

Implementing the Subnetting Strategy

Step-by-Step Deployment

1. Plan the Address Space: Map out all 32 subnets, ensuring they align with organizational needs.
2. Configure Network Devices: Update routers and switches with appropriate subnet masks and routing entries.
3. Assign IP Addresses: Allocate specific IPs within each subnet to devices, reserving network and broadcast addresses.
4. Test Connectivity: Verify that devices within and across subnets communicate as intended.
5. Document the Network Layout: Maintain detailed records of subnet allocations for future troubleshooting and management.

Tools and Techniques

- Subnet Calculators: Utilize online or software tools to automate subnet calculations.
- VLSM (Variable Length Subnet Mask): For more complex scenarios, VLSM allows different-sized subnets within the same network.
- Routing Protocols: Implement protocols like OSPF or EIGRP to facilitate efficient routing across subnets.

Conclusion: Strategic Network Design

The process of subnetting a /24 network into 32 smaller subnets exemplifies the critical role of careful planning in network architecture. By borrowing five bits from the host portion, the administrator effectively creates 32 /29 subnets, each capable of accommodating small groups of devices while optimizing IP address utilization. This approach aligns with best practices

in network segmentation, offering enhanced security, manageability, and scalability.

However, the decision to use /29 subnets must be contextualized within organizational needs. While ideal for small, point-to-point links or specialized segments, larger subnets might be necessary for departmental networks demanding more hosts. Therefore, network administrators should weigh subnet size, future growth, and operational requirements before finalizing their subnetting strategy.

Ultimately, the successful implementation of such subnetting reinforces the importance of foundational networking knowledge, precise calculations, and strategic planning—cornerstones of effective network management in an ever-evolving digital landscape.

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