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## CompTIA®

# Network+

## N10-009

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Figure 7-15. Then determine how many bits the networks have in common. The number of common bits then becomes the number of bits in the CIDR mask.

Key Topic

| Network Address | 1st Octet | 2nd Octet | 3rd Octet | 4th Octet |
|---|---|---|---|---|
| 192.168.32.0 | **11**000000 | **10101**000 | 001000**00** | 00000000 |
| 192.168.33.0 | **11**000000 | **10101**000 | 001000**01** | 00000000 |
| 192.168.34.0 | **11**000000 | **10101**000 | 001000**10** | 00000000 |
| 192.168.35.0 | **11**000000 | **10101**000 | 001000**11** | 00000000 |

All Networks Have 22 Bits in Common

**Figure 7-15** CIDR Calculation Example

Because all four of the network addresses have the first 22 bits in common, and because setting the remaining bits to 0 (11000000.10101000.00100000.00000000) creates the network address 192.168.32.0, these networks can be summarized as 192.168.32.0/22.

## Real-World Case Study

Acme, Inc. has decided to use private IP addresses for its internal LAN and for the WAN. The company will use the private block 10.0.0.0/8 and create enough subnets to cover the number of virtual local area networks (VLANs) it will be using at the headquarters site and at each of the remote offices. The association between the Layer 2 VLANs and the Layer 3 IP subnets will be one-to-one, with each VLAN having its own associated subnet.

The company will have nine VLANs and will use a couple subnets for the WAN connections. For the VLANs, the company plans to use the network mask /12, which will offer enough subnets to meet its needs based on the starting mask /8 for the Class A private address 10.0.0.0/8.

For the WAN connectivity Acme is purchasing from a service provider for connectivity between the remote branch offices and the headquarters site, the company will use /30 masks, which will allow for two hosts on each of the WAN connections. This is enough for each device at the end of the point-to-point WAN connections.

To connect its LANs to the Internet, Acme plans to use NAT, which is going to be performed by its service provider so that traffic going to the Internet will appear to be coming from a globally routable IP address and not from a private address. (You'll learn more about NAT in Chapter 9.)

## Summary

Here are the main topics covered in this chapter:

- A binary math tutorial was provided in this chapter to give you a basic understanding of why binary math is necessary for working with subnet masks.
- The characteristics of IPv4 were presented in this chapter, including IPv4's address format.
- This chapter examined various approaches for assigning IP address information to network devices, including static assignment, dynamic assignment, and APIPA.
- Finally, this chapter provided multiple examples and practice exercises for various subnet calculations.

## Review All the Key Topics

Review the most important topics from this chapter, noted with the Key Topic icon in the outer margin of the page. Table 7-29 lists these key topics and the page number where each is found.

Key Topic

**Table 7-29** Key Topics for Chapter 7

| Key Topic Element | Description | Page Number |
|---|---|---|
| Table 7-1 | Binary Conversion Table | 164 |
| Section | Converting a Binary Number to a Decimal Number | 165 |
| Section | Converting a Decimal Number to a Binary Number | 165 |
| Figure 7-2 | Dividing an IP Address into a Network Portion and a Host Portion | 172 |
| Table 7-19 | IP Address Classes | 173 |
| Table 7-20 | Private IP Networks | 174 |
| Table 7-21 | Assignable IP Addresses | 182 |
| Table 7-22 | Dotted-Decimal and Prefix-Notation Representations for IPv4 Subnets | 182 |
| Table 7-23 | Subnet Octet Values | 183 |
| Formula | Number of created subnets | 185 |
| Formula | Number of borrowed bits | 186 |
| Formula | Number of host bits | 186 |
| Formula | Number of assignable IP addresses in a subnet | 186 |

| Key Topic Element | Description | Page Number |
|---|---|---|
| Table 7-24 | Number of Subnets Created by a Specified Number of Borrowed Bits | 187 |
| Table 7-25 | Number of Supported Hosts, Given a Specified Number of Host Bits | 188 |
| Step list | Steps for calculating subnets | 190 |
| Table 7-26 | Usable IP Address Ranges for the 192.168.10.0/27 Subnets | 191 |
| Figure 7-15 | CIDR Calculation Example | 197 |

## Complete Tables and Lists from Memory

Print a copy of Appendix C, "Memory Tables," or at least the section for this chapter and complete as many of the tables as possible from memory. Appendix D, "Memory Tables Answer Key," includes the completed tables and lists so you can check your work.

## Define Key Terms

Define the following key terms from this chapter and check your answers in the Glossary:

Automatic Private IP Addressing (APIPA), Class A, Class B, Class C, Class D, Class E, classless inter-domain routing (CIDR), IPv4 address classes, localhost, loopback, private IP addressing, RFC1918, subnetting, Variable-Length Subnet Masking (VLSM)

## Additional Resources

**Subnetting—Hosts per Subnet:** https://www.ajsnetworking.com/subnetting

**Subnetting—What Mask to Use:** https://www.ajsnetworking.com/subnetting2

**Subnetting—"I Feel the Need, the Need for Speed":** https://www.ajsnetworking.com/subnetting3

## Review Questions

The answers to these review questions appear in Appendix A, "Answers to Review Questions."

1. What is the binary representation of the decimal number 117?
   a. 10110101
   b. 01110101

c. 10110110
d. 01101001

2. What is the decimal equivalent of the binary number 10110100?
   a. 114
   b. 190
   c. 172
   d. 180

3. What is the class of IP address 10.1.2.3/24?
   a. Class A
   b. Class B
   c. Class C
   d. Class D

4. What is the classful subnet mask for a Class B network?
   a. 255.255.0.0
   b. 255.255.255.255
   c. 255.255.255.0
   d. 255.0.0.0

5. Which of the following is a dynamic approach to assigning routable IP addresses to networked devices?
   a. CIDR
   b. APIPA
   c. RFC1918
   d. DHCP

6. How many assignable IP addresses exist in the 172.16.1.10/27 network?
   a. 30
   b. 32
   c. 14
   d. 64

7. What is the prefix notation for the subnet mask 255.255.255.240?
   a. /20
   b. /24
   c. /28
   d. /29

8. Your company has been assigned the 192.168.30.0/24 network for use at one of its sites. You need to use a subnet mask that will accommodate seven subnets while simultaneously accommodating the maximum number of hosts per subnet. What subnet mask should you use?
   a. /24
   b. /26
   c. /27
   d. /28

9. A client with IP address 172.16.18.5/18 belongs to what network?
   a. 172.16.0.0/18
   b. 172.16.64.0/18
   c. 172.16.96.0/18
   d. 172.16.128.0/18

10. What effect does classless inter-domain routing have on the subnet mask in IP addressing?
    a. The mask is not changed
    b. The mask is lengthened
    c. The mask is shortened
    d. The mask is eliminated

11. Which of the following is not a private address range as defined in RFC1918?
    a. 127.x.x.x
    b. 10.x.x.x
    c. 172.16.x.x to 172.31.x.x
    d. 192.168.x.x

**This chapter covers the following topics related to Objective 1.8 (Summarize evolving use cases for modern network environments) of the CompTIA Network+ N10-009 certification exam:**

- Software-defined network (SDN) and software-defined wide area network (SD-WAN)
  - Application aware
  - Zero-touch provisioning
  - Transport agnostic
  - Central policy management
- Virtual Extensible Local Area Network (VXLAN)
  - Data center interconnect (DCI)
  - Layer 2 encapsulation
- Zero trust architecture (ZTA)
  - Policy-based authentication
  - Authorization
  - Least privilege access
- Secure Access Secure Edge (SASE)/Security Service Edge (SSE)
- Infrastructure as code (IaC)
  - Automation
    - Playbooks/templates/reusable tasks
    - Configuration drift/compliance
    - Upgrades
  - Dynamic inventories
- Source control
  - Version control
  - Central repository
  - Conflict identification
  - Branching
- IPv6 addressing
  - Mitigating address exhaustion
  - Compatibility requirements
    - Tunneling
    - Dual stack
    - NAT64