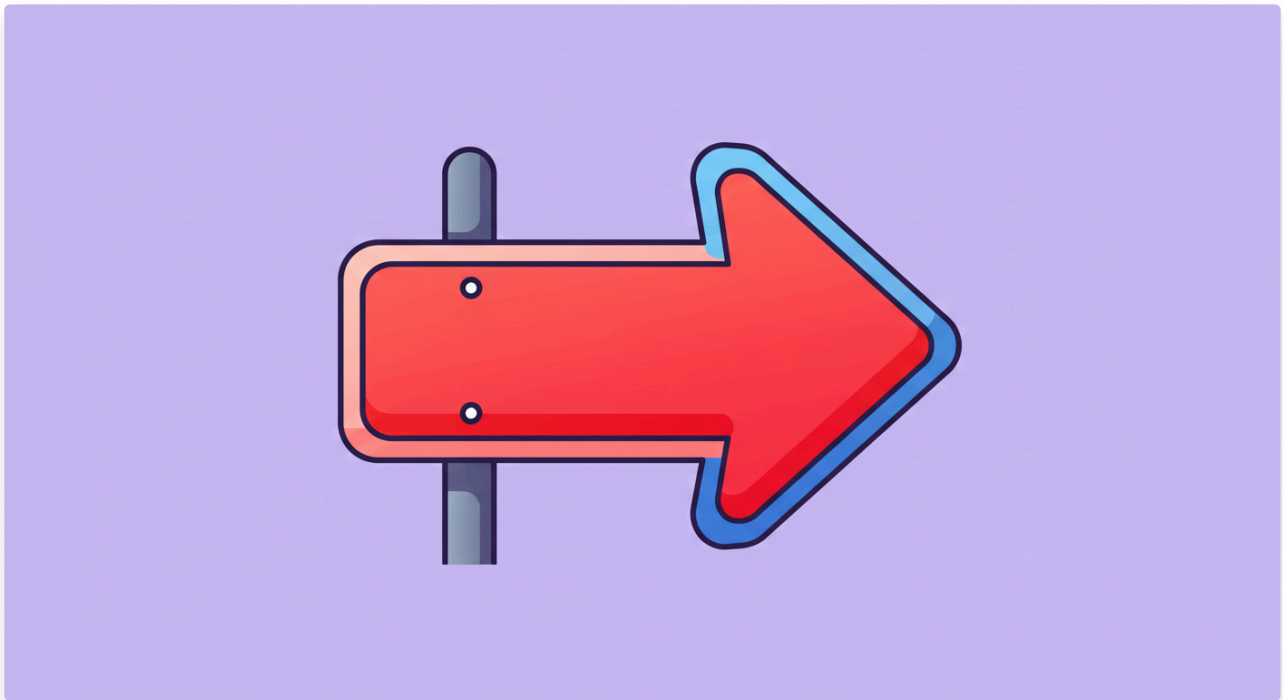


Network Protocols

Textbook

Network Protocols



Predict: What do you think an internet protocol is? Have you heard the word protocol before?

Networks rely on rules (protocols), unique identifiers (addresses), and specific frequencies for communication.

Common Network Protocols: The Rules of the Road

Network protocols are sets of rules for how data is formatted, sent, and received.

- **HTTP/HTTPS:** For web Browse; HTTPS adds encryption for security.
- **FTP:** For transferring files between computers.
- **Email Protocols (SMTP, POP3, IMAP):** Handle sending (SMTP) and receiving/managing (POP3/IMAP) emails.
- **TCP/IP:** The core Internet suite. **TCP** ensures reliable data delivery, while **IP** handles addressing and routing data packets.

How Devices Are Identified on a Network: Digital Addresses

Devices need unique identifiers, mainly **IP addresses**.

- **IP Address (Internet Protocol Address):** A numerical label identifying a device on a network and its location.

- **Public IP Addresses:** Unique addresses assigned by your ISP, visible to the Internet, allowing outside communication to your network (e.g., your router's address).
- **Private IP Addresses:** Used only within a local network (e.g., home Wi-Fi), not directly visible on the Internet. Multiple devices can share one public IP through a router.
- **MAC Address (Media Access Control Address):** A unique, permanent hardware identifier for your network interface card (NIC).

Internet Protocol Versions: IPv4 vs. IPv6

The Internet's growth led to new IP address versions.

- **IPv4 (Internet Protocol Version 4):**
 - 32-bit addresses, seen as four numbers separated by dots (e.g., `192.168.1.100`).
 - Underlying structure is **binary**.
 - Limited to about 4.3 billion addresses, leading to shortages.
- **IPv6 (Internet Protocol Version 6):**
 - 128-bit addresses, seen as eight groups of **hexadecimal** digits (e.g., `2001:0db8:85a3::8a2e:0370:7334`).
 - Vastly more addresses (approx. 340 undecillion).

Similarities: Both identify devices and enable routing.

Differences: Length, notation (binary vs. hexadecimal), and address capacity. IPv6 is the future.

2.4 GHz and 5 GHz Wireless Networks: Speed vs. Range

Wi-Fi uses different radio frequency bands with distinct characteristics:

- **2.4 GHz Wireless Networks:**
 - **Advantages:** Longer range, better at penetrating obstacles.
 - **Disadvantages:** Slower speeds, more prone to interference from other devices (e.g., microwaves).
- **5 GHz Wireless Networks:**
 - **Advantages:** Faster speeds, less interference (more channels).
 - **Disadvantages:** Shorter range, poorer obstacle penetration.

Which to use? 2.4 GHz is good for general use or devices far from the router. 5 GHz is better for high-bandwidth activities (streaming, gaming) when close to the router.

Critical Thinking Questions

1. Imagine you are developing a new online game that requires very fast, real-time communication between players. Which Wi-Fi frequency band (2.4 GHz or 5 GHz) would you recommend players use for the best experience, and why? What are the potential trade-offs for those players?
2. Your home network has several devices: a laptop, a smart TV, and a smart refrigerator. Explain how each of these devices likely obtains its IP address (public or private), and how your home router uses both public and private IP addresses to allow all these devices to access the Internet simultaneously.
3. Given that IPv4 addresses are running out, why do you think the transition to IPv6 hasn't been instantaneous, and what challenges might an internet service provider or a large company face when trying to fully switch their entire network over to IPv6?

Questions (5)

1. A user is accessing their online banking website. Which network protocol ensures that the data exchanged, like their password and account details, is encrypted and secure?

MULTIPLE CHOICE

Choose the correct answer:

- A. HTTP
- B. FTP
- C. HTTPS
- D. SMTP

2. You need to send a large video file from your computer to a friend's computer directly, without using email or a cloud storage service. Which network protocol is designed specifically for transferring files between computers?

MULTIPLE CHOICE

Choose the correct answer:

- A. HTTP
- B. FTP
- C. TCP/IP
- D. IMAP

3. A gamer wants the fastest possible Wi-Fi connection for their online game, even if they have to be close to the router. Which wireless network frequency band would you recommend for the best experience?

MULTIPLE CHOICE

Choose the correct answer:

- A. 2.4 GHz
- B. 5 GHz
- C. Both 2.4 GHz and 5 GHz, as they offer the same speed.
- D. Neither, as Wi-Fi is unsuitable for gaming.

4. Your home network has multiple devices, including a laptop, a smart TV, and a smart refrigerator. How do these devices likely obtain their IP address within your home network?

MULTIPLE CHOICE

Choose the correct answer:

- A. They all receive a unique public IP address directly from the Internet.
- B. They are all assigned the same public IP address by the router.
- C. They each obtain a private IP address from the router, which then uses a single public IP to access the Internet.
- D. They do not need IP addresses as long as they have a MAC address.

5. What is the primary function of the Internet Protocol (IP) part of the TCP/IP suite?

MULTIPLE CHOICE

Choose the correct answer:

- A. To ensure reliable data delivery.
- B. To encrypt web traffic.
- C. To handle addressing and routing data packets.
- D. To manage email sending.

Answer Keys & Solutions

Questions

1. A user is accessing their online banking website. Which network protocol ensures that the data exchanged, like their password and account details, is encrypted and secure?

MULTIPLE CHOICE

Correct Answer:

- | | |
|----------|-------------|
| A. HTTP | ✗ Incorrect |
| B. FTP | ✗ Incorrect |
| C. HTTPS | ✓ Correct |
| D. SMTP | ✗ Incorrect |

Explanation:

Look for the protocol specifically noted for adding encryption for security during web Browse.

2. You need to send a large video file from your computer to a friend's computer directly, without using email or a cloud storage service. Which network protocol is designed specifically for transferring files between computers?

MULTIPLE CHOICE

Correct Answer:

- | | |
|-----------|-------------|
| A. HTTP | ✗ Incorrect |
| B. FTP | ✓ Correct |
| C. TCP/IP | ✗ Incorrect |
| D. IMAP | ✗ Incorrect |

Explanation:

Recall the protocol whose name explicitly refers to "File Transfer."

3. A gamer wants the fastest possible Wi-Fi connection for their online game, even if they have to be close to the router. Which wireless network frequency band would you recommend for the best experience?

MULTIPLE CHOICE

Correct Answer:

- A. 2.4 GHz ✗ Incorrect
- B. 5 GHz ✓ Correct
- C. Both 2.4 GHz and 5 GHz, as they offer the same speed. ✗ Incorrect
- D. Neither, as Wi-Fi is unsuitable for gaming. ✗ Incorrect

Explanation:

Think about which frequency band offers faster speeds and less interference.

4. Your home network has multiple devices, including a laptop, a smart TV, and a smart refrigerator. How do these devices likely obtain their IP address within your home network?

MULTIPLE CHOICE

Correct Answer:

- A. They all receive a unique public IP address directly from the Internet. ✗ Incorrect
- B. They are all assigned the same public IP address by the router. ✗ Incorrect
- C. They each obtain a private IP address from the router, which then uses a single public IP to access the Internet. ✓ Correct
- D. They do not need IP addresses as long as they have a MAC address. ✗ Incorrect

Explanation:

Consider how many devices can share one internet connection and still communicate individually within a home network.

5. What is the primary function of the Internet Protocol (IP) part of the TCP/IP suite?

MULTIPLE CHOICE

Correct Answer:

A. To ensure reliable data delivery.

✗ Incorrect

B. To encrypt web traffic.

✗ Incorrect

C. To handle addressing and routing data packets.

✓ Correct

D. To manage email sending.

✗ Incorrect

Explanation:

Recall which part of TCP/IP is responsible for getting packets to the right place.