

14.1 Protocols

Name: _____ Class: _____ Date: _____

Total: 20 marks

Objective

Build the skills to answer exam questions on **protocols** 协议—why they are needed, the TCP/IP layered model, and the common application protocols.

You must be able to:

- explain why a **protocol** is essential, and the benefit of a **layered** model
- describe the four layers of the **TCP/IP** suite
- state the purpose of **HTTP**, **FTP**, **SMTP**, **POP3**, **IMAP**, **BitTorrent** and compare **TCP/UDP**

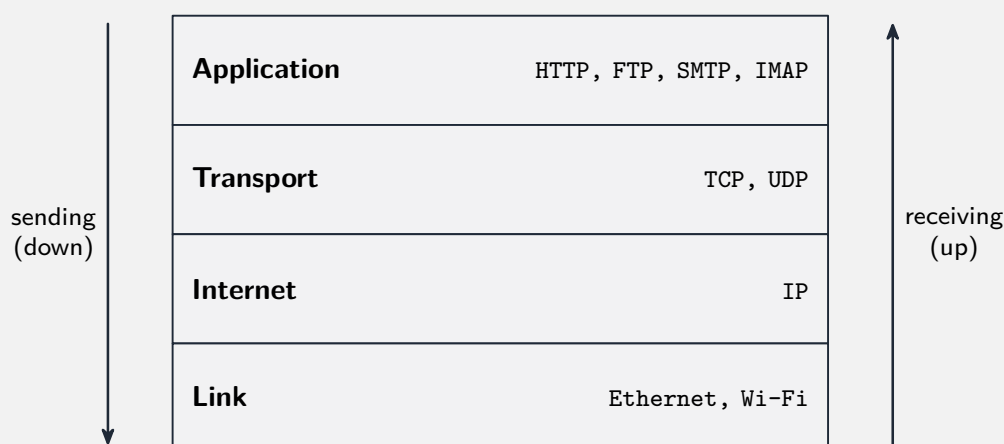
1 Worked examples

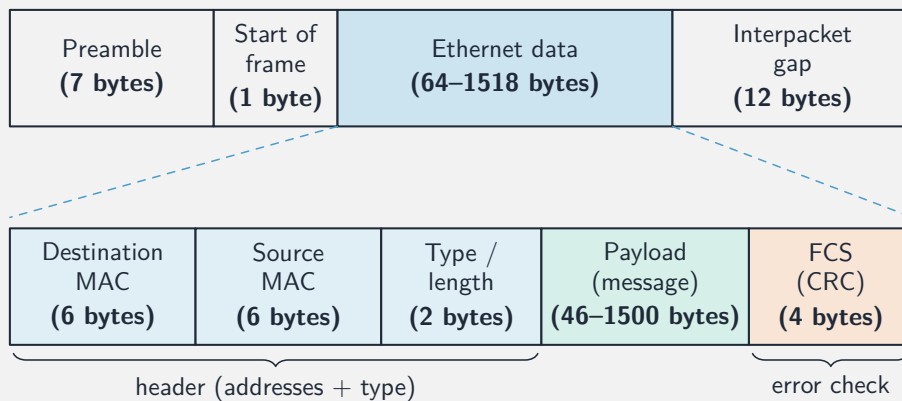
Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ Why protocols, and layers

A **protocol** is an agreed **set of rules** for communication —the data **format**, the **order** of messages, their **meaning**, **timing** and **error handling**. Both ends must follow the same rules or the bytes are meaningless.

Networking is split into **layers**, each with one job, talking only to the layers above and below. Benefits: **modularity** (swap one layer without touching the others), **standardisation**, and **abstraction**.





An Ethernet frame carries the protocol data

Each layer has one job:

- **Application** —provides network services to programs (HTTP for the web, SMTP for email).
- **Transport** —splits the data into **packets** and provides reliable, in-order delivery (TCP) or fast send-and-forget (UDP); adds **port numbers**.
- **Internet** —adds **IP addresses** and **routes** the packets across networks.
- **Link** —sends the bits over the physical connection (Ethernet, Wi-Fi) using **MAC addresses**.

■ TCP vs UDP (transport layer)

- **TCP** —**connection-oriented**: reliable, in-order delivery, retransmits lost packets (HTTP, email). Higher overhead.
- **UDP** —**connectionless**: send-and-forget, no ordering or acknowledgements (streaming, gaming, DNS). Low overhead.

■ Application protocols

Protocol	Purpose
HTTP	fetch web pages
FTP	transfer files
SMTP	send email
POP3 / IMAP	retrieve email (IMAP keeps it on the server)
BitTorrent	peer-to-peer file sharing

2 Practice

Now apply the methods above.

2.1 State what a **protocol** is.

[1]

2.2 State **one** benefit of using a **layered** model for networking. [1]

2.3 Name the **four** layers of the TCP/IP suite, **from top to bottom**. [2]

2.4 State which protocol is used to **send** an email. [1]

3 Exam-style questions

3.1 State **two** differences between **TCP** and **UDP**. [2]

3.2 State the purpose of each protocol: **HTTP**, **FTP**, **SMTP**. [3]

3.3 Explain why a protocol is **essential** for communication between two computers. [2]

3.4 State **one** difference between **POP3** and **IMAP**. [2]

3.5 Describe the purpose of the **Application layer** and the **Transport layer** of the TCP/IP suite. [4]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **14.1 Protocols** past-paper sheet in the Library, or try these in **Practice mode**:

- 9618/31 J25 —Q3 (TCP/IP layers)
- 9618/32 N25 —Q3 (communication protocols)
- 9618/33 J25 —Q4 (application-layer protocols)
- 9618/31 N24 —Q4 (the protocol suite)

Solutions

2.1 An agreed **set of rules** governing how devices communicate (format, order, meaning, timing, errors).

2.2 Any one: **modularity** (change one layer without the others); standardisation/interoperability; abstraction (hide details).

2.3 **Application** → **Transport** → **Internet** → **Link**.

2.4 SMTP.

3.1 Any two: TCP is **connection-oriented**, UDP **connectionless**; TCP **guarantees delivery and order**, UDP does not; TCP **retransmits** lost packets, UDP does not; TCP has higher overhead.

3.2 **HTTP** —request/transfer **web pages**; **FTP** —transfer **files**; **SMTP** —send email.

3.3 Without an agreed protocol the two computers have no shared rules for **format/order/meaning**, so each side cannot interpret the other's data and communication **fails**.

3.4 **POP3** usually **downloads and removes** mail from the server; **IMAP** **keeps** mail on the server and syncs across devices.

3.5 **Application layer** —provides network services to the user's programs (e.g. HTTP, SMTP) and formats the data. **Transport layer** —splits the data into packets and provides reliable, in-order delivery (TCP) using port numbers.