Standards and common protocols

Computer systems (Paper 1) · revision notes

What standards and protocols are, and the purpose of the common protocols TCP/IP, HTTP, HTTPS, FTP, POP, IMAP and SMTP. Expect questions asking you to match protocols to tasks, compare POP with IMAP or HTTP with HTTPS, and describe what TCP/IP does.

Key facts

- Protocol = set of rules for communication between devices
- Standard = agreed rules so products from different manufacturers work together
- TCP: packets, sequence numbers, error checking, re-sending, reassembly
- IP: adds IP addresses and routes packets
- HTTP: web pages. HTTPS: web pages, encrypted
- FTP: transfers files (e.g. uploading to a web server)
- SMTP: sends email
- POP: retrieves email; downloads it and usually removes it from the server
- IMAP: retrieves email; keeps it on the server, synced across devices

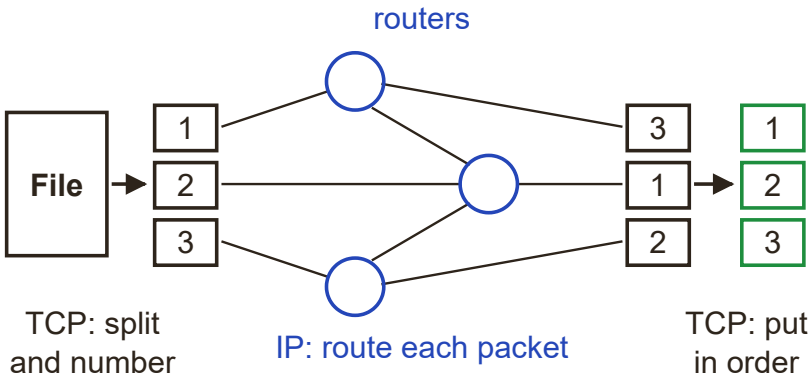
Notes

Standards and protocols

- A **standard** is an agreed set of rules or specifications for hardware, software or data formats, e.g. USB, Wi-Fi, Ethernet, Bluetooth, Unicode, HTML and JPEG.
- Standards let products from **different manufacturers work together**: any USB device works in any USB port, and any browser can display an HTML page.
- A **protocol** is a set of rules for how devices communicate, e.g. the format of the data, how it is addressed and how errors are checked.

TCP/IP

- **TCP (Transmission Control Protocol)** splits data into **packets**, gives each one a sequence number, checks that they arrive, asks for lost or damaged packets to be re-sent, and **reassembles** them in the right order.
- **IP (Internet Protocol)** adds the source and destination **IP addresses** to each packet and **routes** the packets across networks.

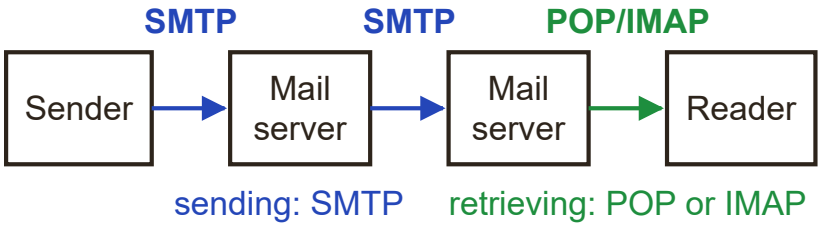


TCP splits and reassembles; IP addresses and routes each packet, which may take a different route

- Together, TCP/IP is the set of protocols used to send data across the Internet.

Web, file and email protocols

- **HTTP (Hypertext Transfer Protocol)**: used by a browser to request web pages and by a web server to send them.
- **HTTPS (Hypertext Transfer Protocol Secure)**: HTTP with **encryption**, so intercepted data cannot be understood. Used for logins, banking and payments.
- **FTP (File Transfer Protocol)**: transfers files between computers over a network, e.g. uploading a website's files to a web server.
- **SMTP (Simple Mail Transfer Protocol)**: **sends** email from a device to a mail server, and between mail servers.
- **POP (Post Office Protocol)**: **retrieves** email by downloading it to one device, usually deleting it from the server.
- **IMAP (Internet Message Access Protocol)**: **retrieves** email but keeps it on the server, so it stays in sync on every device.



SMTP sends email; POP or IMAP retrieve it

How to answer each type of question

Match a protocol to a task

1 mark each | Grade 4

1. Decide whether the task is about web pages, files, sending email or reading email.
2. Sending email is SMTP; reading it is POP or IMAP (IMAP if several devices must stay in sync).
3. Anything with passwords or card details on a website → HTTPS.

Example. State the most suitable protocol for each task.
(a) Uploading a website's files to a web server. [1]
(b) Sending an email from a phone to a mail server. [1]
(c) Reading email on a phone and a laptop so that both show the same messages. [1]
(d) Logging in to an online bank. [1]

Model answer.

(a) FTP (1)
(b) SMTP (1)
(c) IMAP (1)
(d) HTTPS (1)

Explain why standards are needed

2 marks | Grade 4

1. Say that a standard is an agreed set of rules that manufacturers follow.
2. Give the effect: products from different companies work together, with an example.

Example. Explain why standards are important in computing. Use an example in your answer. [2]

Model answer. Standards are agreed rules that manufacturers follow, so hardware and software from different companies can work together (1). For example, any Wi-Fi device can connect to any Wi-Fi router because they all follow the same standard (1).

Compare two protocols

2 to 4 marks | Grade 6

1. Say what the two protocols have in common.
2. Give the key difference and its effect for the user.
3. Mention both protocols in each point.

Example. Compare the POP and IMAP protocols. [3]

Model answer. Both are used to retrieve email from a mail server (1). POP downloads emails to one device and usually deletes them from the server, whereas IMAP keeps the emails on the server (1). So with IMAP, emails can be read on several devices and stay in sync, whereas with POP they are only on the device that downloaded them (1).

Describe the purpose of TCP/IP

3 to 4 marks | **Grade 7**

1. Give TCP's jobs: split into packets, number them, check them, re-send lost ones, reassemble.
2. Give IP's jobs: add IP addresses, route the packets.
3. Cover both parts: an answer about only TCP or only IP will not get full marks.

Example. Describe the purpose of TCP/IP when a file is sent across the Internet. [4]

Model answer. TCP splits the file into packets and gives each one a sequence number (1). TCP checks that all the packets have arrived and asks for any missing or damaged packets to be re-sent (1). TCP uses the sequence numbers to put the packets back in the correct order (1). IP adds the destination IP address to each packet and routes the packets across the networks (1).

Don't lose marks

- Saying SMTP is used to receive email. SMTP sends it; POP and IMAP retrieve it.
- Saying HTTPS 'makes the website safe'. It encrypts data in transit; the website itself could still be fake.
- Describing TCP/IP as one job. TCP handles the packets; IP handles addressing and routing.
- Thinking standards only apply to networks. Standards also cover hardware (e.g. USB) and file formats (e.g. JPEG).

More tips

Memory tricks

- SMTP = 'Send Mail To People'. POP pops email off the server; IMAP keeps it In the Mail server.
- HTTPS: the S stands for Secure, which means encrypted.
- TCP is the packing department (split, number, check, rebuild); IP is the delivery driver (address and route).

Exam technique

- Learn the full name of each protocol: it hints at the purpose and can be worth a mark.
- In 'compare' questions, give a similarity as well as a difference when the marks allow.
- Use the words 'packets', 'sequence number' and 'route' in TCP/IP answers.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Define a protocol**
A set of rules for how devices communicate and transfer data.

Grade 4 — **State the purpose of each common protocol**
HTTP/HTTPS: web pages; FTP: files; SMTP: sending email; POP/IMAP: retrieving email; TCP/IP: packets and routing.

Grade 4 — **Explain why standards are needed**
Agreed rules let hardware and software from different manufacturers work together.

Grade 5 **Choose the right protocol for a task**

E.g. FTP to upload website files, HTTPS to enter card details, IMAP to keep email in sync across devices.

Grade 6 **Compare POP with IMAP**

Both retrieve email; POP downloads it and usually deletes it from the server, IMAP keeps it on the server and in sync.

Grade 7 **Describe the roles of TCP and IP**

TCP splits data into numbered packets, checks and reassembles them; IP addresses and routes the packets.

Grade 8 **Describe an email's journey naming protocols**

SMTP to send and to pass between mail servers, POP or IMAP to retrieve, TCP/IP throughout.

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