

NWEN 243

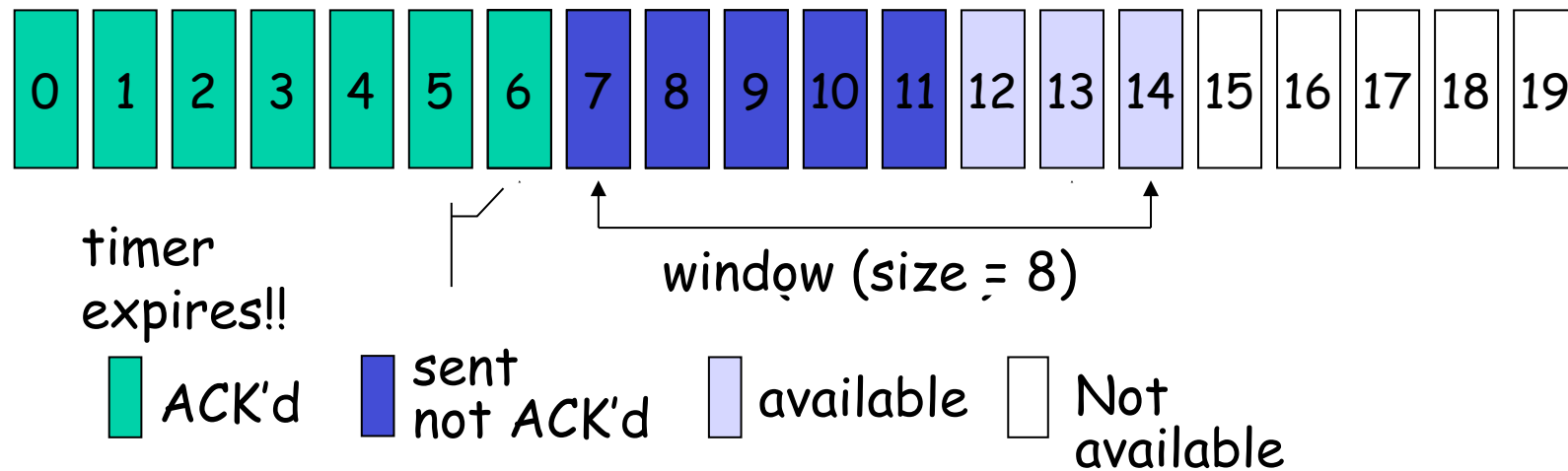
Q&A



Sample question

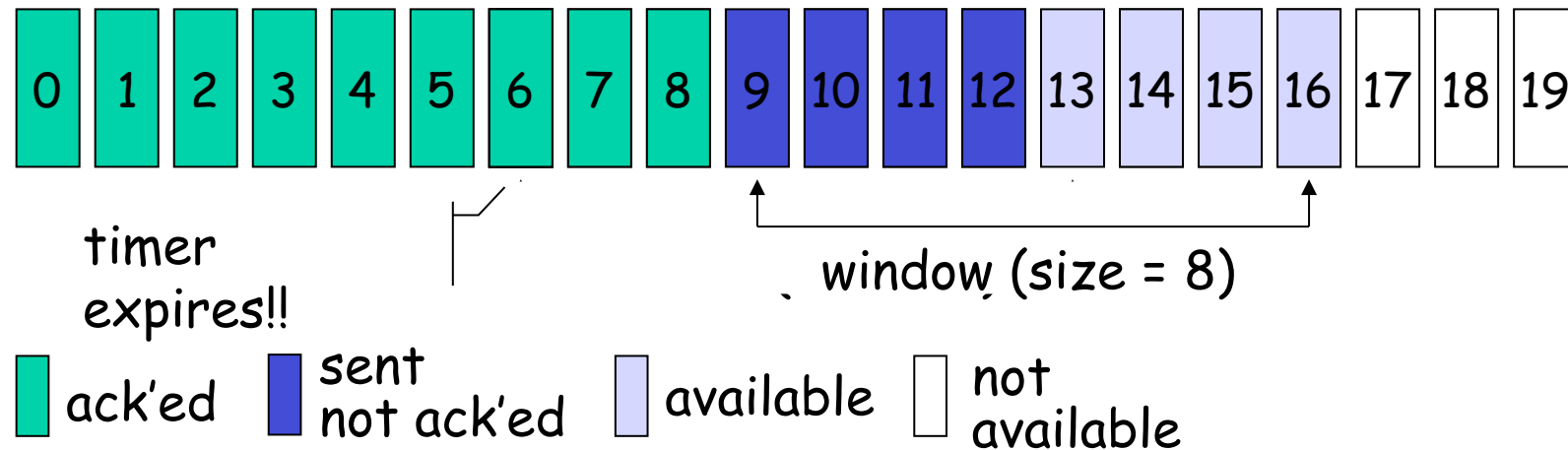
- Consider the use of a very big sliding window (> 5).
- The sender wants to send **5 messages** to the receiver.
- Each message (including acknowledgements) will be sent at intervals of **1 time unit**, starting at **time 0**.
- The timeout period is **3 time units**.
- Message 2 is lost in transmission and is recovered through re-transmission.
- With **GoBackN**, how many time units will it take to complete the transmission of 5 messages successfully?

Go Back N



- Very simple receiver, only accepts packets that arrive in-order and **discards others**.
- Send each packet in window in turn, window moves on when **first** packet in window is acknowledged.
- Timeout on first packet, then all **UNACKNOWLEDGED** packets resent

Selective Repeat



- Can send fewer packets at the cost of making the protocol more **complicated**.
- Packets are **individually acknowledged**.
- Only one packet resent on timer expiry.

Answer

Time 0: message 1 is sent by A

Time 1: message 2 is sent by A, message 1 is received by B, acknowledgement 1 is sent by B

Time 2: message 2 is lost, message 3 is sent by A, acknowledgement 1 is received by A, the sliding window is moved forward

Time 3: message 4 is sent by A, message 3 is received and discarded by B

Time 4: message 2 timeout, message 2 is sent by A, message 4 is received and discarded by B

Time 5: message 3 is sent by A, message 2 is received by B, acknowledge 2 is sent by B

Time 6: message 4 is sent by A, acknowledge 2 is received by A, message 3 is received by B, acknowledge 3 is sent by B

Time 7: message 5 is sent by A, acknowledge 3 is received by A, message 4 is received by B, acknowledge 4 is sent by B.

Time 8: acknowledge 4 is received by A, message 5 is received by B, acknowledge 5 is sent by B.

Time 9: acknowledge 5 is received by A

The case of using Selective Repeat

Time 0: message 1 is sent by A

Time 1: message 2 is sent by A, message 1 is received by B, acknowledgement 1 is sent by B

Time 2: message 2 is lost, message 3 is sent by A, acknowledgement 1 is received by A, the sliding window is moved forward to include message 5

Time 3: message 4 is sent by A, message 3 is received by B, acknowledgement 3 is sent by B

Time 4: message 2 timeout, message 2 is sent by A, acknowledgement 3 is received by A, message 4 is received by B, acknowledgement 4 is sent by B

Time 5: message 5 is sent by A, acknowledge 4 is received by A, message 2 is received by B, acknowledgement 2 is sent by B

Time 6: acknowledgement 2 is received by A, message 5 is received by B, acknowledgement 5 is sent by B

Time 7: acknowledgement 5 is received by A

Quick exercise

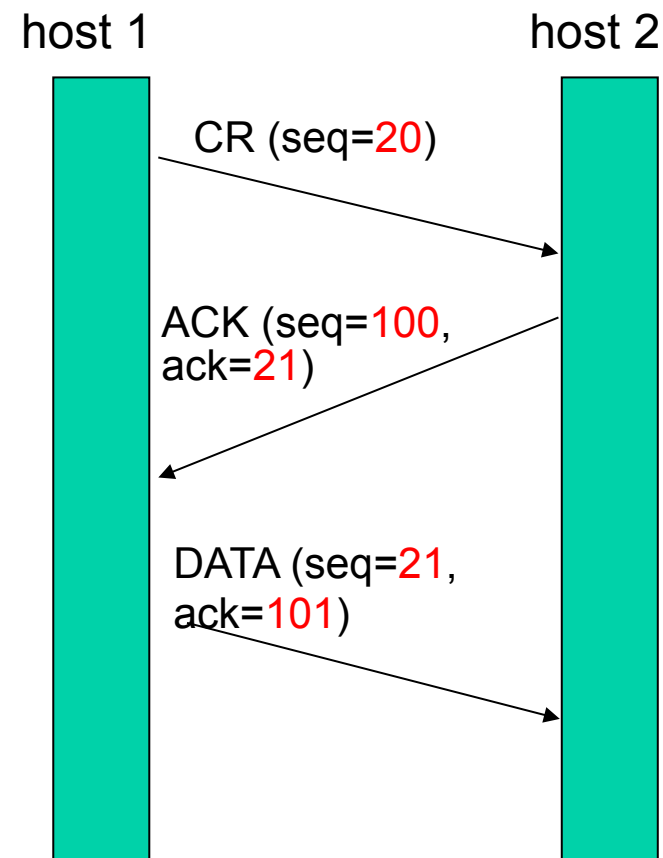
- Using 5-bit sequence numbers, what is the maximum size of the receive window for the GoBackN protocol?
 - A. 1
 - B. 16
 - C. 31
 - D. 32

Sample question

- Show the complete process of a TCP 3-way handshake,
- The TCP client picks sequence number 20
- The TCP server picks sequence number 100
- Assume nothing is lost, and everything proceeds as normal.

Establishing a Connection

- Host 1 initiates and chooses its initial sequence number 20.
- Host 2 replies with its own initial sequence number 100 and acknowledges host 1.
- Host 1 begins data transmission



Answer

- Step 1: client sends SYN segment (connection request) with **seq=20** to server
- Step 2: server sends SYN+ACK segment with **seq=100** and **ack=21** to client
- Step 3, client sends ACK with **seq=21** and **ack=101** to server
 - Perhaps some data payload is also carried with this TCP segment.

Quick exercise

- A TCP client starts a TCP connection by sending a **SYN segment** to a server with seq. # X . Why does the server ACK for $X+1$ instead of just X ?
 - A. SYN segment carries one byte of data payload
 - B. ACK for $X+1$ in order to confirm that the SYN segment has been received successfully.
 - C. The ACK number can be greater than $X+1$ if the SYN segment carries several bytes of data payload.
 - D. None of the above

Quick exercise

- The **FIN segment** consumes _____ sequence numbers if it does not carry any data.
 - A. One
 - B. Two
 - C. Three
 - D. None

Quick exercise

- Which attributes of UDP make it suitable for large-scale multimedia broadcast/multicast communication?
 - A. Stateless
 - B. Connectionless
 - C. unidirectional
 - D. Unreliable

Quick exercise

- Why the source port field in the header of a User Datagram Protocol (UDP) message is optional?
 - A. The UDP sender can be addressed by other means.
 - B. The UDP receiver does not need to know the sender of a message.
 - C. UDP communication can be uni-directional.
 - D. There is no source port field in the UDP datagram header.

Quick exercise

- Which Internet services typically rely on UDP for communication?
 - A. DNS
 - B. SNMP
 - C. RIP
 - D. DHCP

Sample question

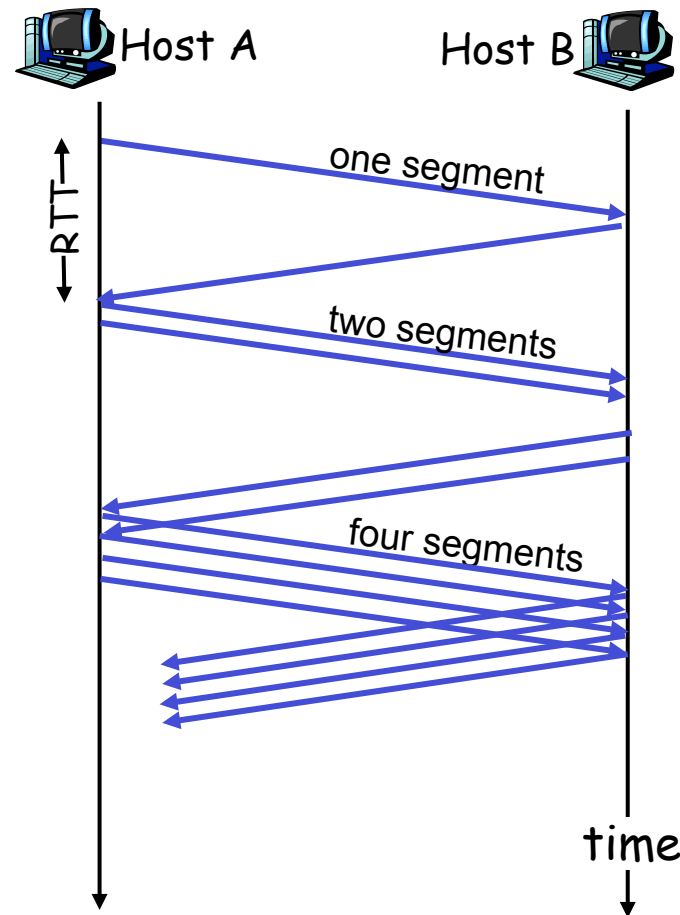
- Why would a TCP and UDP "phone call" likely have equivalent performance characteristics in practice?

Sample question

- Explain why the TCP slow start algorithm may not actually be slow.

TCP Slow Start

- Probe a link's capacity...



Answer

- Every time acknowledgement is received, the congestion window will be doubled.
- As a result, the size of the congestion window increases exponentially fast.

Quick exercise

- If TCP slow start process begins at time 0, after _____ RTTs the size of the congestion window will become 16.
 - A. 1
 - B. 2
 - C. 3
 - D. 4

Sample question

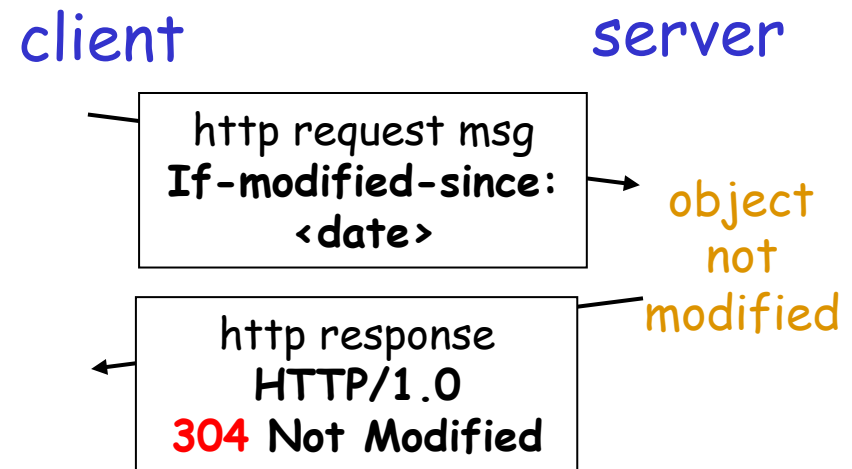
- What is the difference between `read()` and `recv()` in socket programming?

Sample question

- Explain how a HTTP client can make a **conditional GET** request.
- How the HTTP server should respond to the request if no modification is made to the requested Web object.

Conditional GET

- **Goal:** don't send object if client has up-to-date cached version
- **client:** specify date of cached copy in http request
 - **If-modified-since:** <date>
- **server:** response contains no object if cached copy is up-to-date:
 - HTTP/1.0 **304** Not Modified



Quick exercise

- How to maintain state information during an HTTP conversation?
 - A. Impossible to main state information
 - B. Keep state information as a session object in a Web browser
 - C. Keep state information as cookies in a Web browser
 - D. None of the above

Meaning of the first digit

1xx

Success

2xx

Server error

3xx

Redirection

4xx

Informational

5xx

Client error

Sample question

- What is the difference between the “no-cache” and “no-store” options for the Cache-Control HTTP header?

HTTP headers for cache control

- **Cache-Control** HTTP header
 - **no-cache**: force caches to submit the request to the original server for validation before releasing a cached copy.
 - **no-store**: instruct caches not to keep a local copy under any conditions.

Sample question

- Identify the potential benefits of increasing cache capacity of Web browsers.

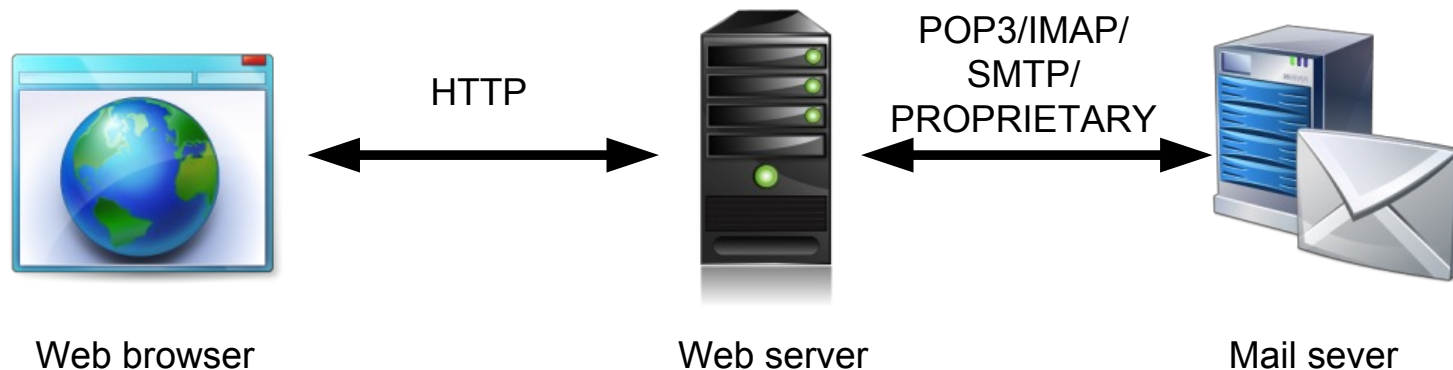
Quick exercise

- What is the HTTP **trace command** used for?
 - A. Traces the routers involved in handling the HTTP request.
 - B. Identifies the server that accepts the HTTP request.
 - C. Echoes back the received request.
 - D. Test the HTTP server is running.

Sample question

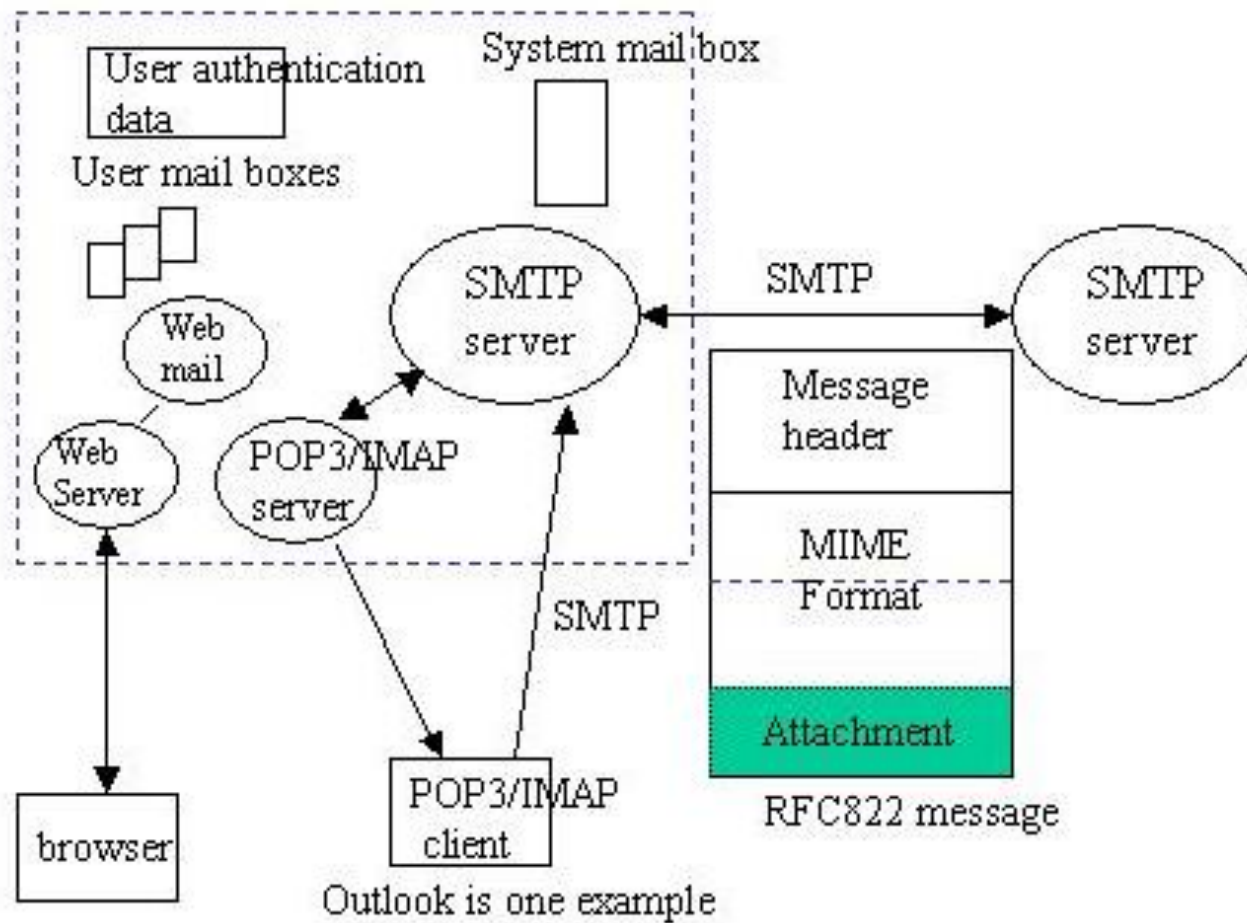
- Draw a diagram that illustrates how end users access their email box through a **Webmail** interface.
- In your diagram, clearly indicate
 - The **type of each server** used
 - The **protocols** that can be used to support the communication between a client and a server or between any two server computers.

Answer



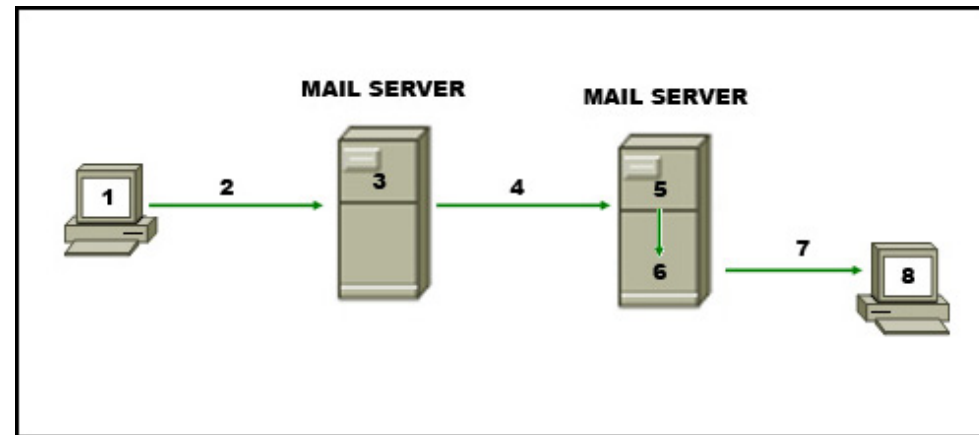
- Two servers: **Web server** and **mail server**
- **HTTP** is used to support the communication between a web browser at the client side and the web server.
- **IMAP, POP**, proprietary protocol can be used to support the communication between the web server and the mail server.

A more comprehensive diagram



Quick exercise

- Refer to the electronic mail delivery process



- Which protocol may be used at step 7?
 - A. SMTP
 - B. HTTP
 - C. POP
 - D. IMAP

Sample question

- SMTP indicates the end of the mail data by sending a line containing only a period.
- A **transparency procedure** should be used to prevent this from interfering with the user's text.
- Present a transparency procedure and show how it can solve the interference problem.

Sample SMTP Interaction

```
S: 220 lentil.edu
C: HELO halva.fr
S: 250 Hello halva.fr, pleased to meet you
C: MAIL FROM: <alice@halva.fr>
S: 250 alice@halva.fr... Sender ok
C: RCPT TO: <bob@lentil.edu>
S: 250 bob@lentil.edu ... Recipient ok
C: DATA
S: 354 Enter mail, end with "." on a line by itself
C: Do you like dahl?
C: How about with naan?
C: .
S: 250 Message accepted for delivery
C: QUIT
S: 221 lentil.edu closing connection
```



Answer

- Before sending a line of mail text the sender-SMTP checks the first character of the line. If it is a period, one additional period is inserted at the beginning of the line.
- When a line of mail text is received by the receiver-SMTP it checks the line. If the line is composed of a single period it is the end of mail. If the first character is a period and there are other characters on the line, the first character is deleted.

- Example

C: DATA

S: 354 Enter mail, end with "." on a line by itself

C: Do you like dahl?

C: How about with naan?

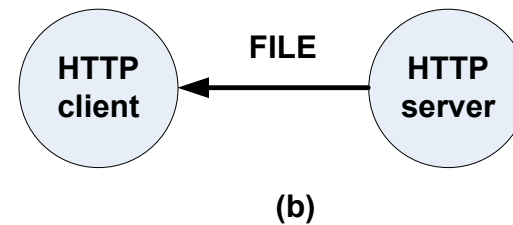
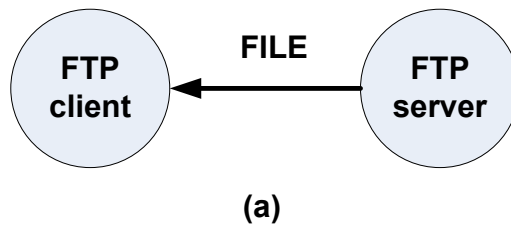
C: . . .

C: . . .

S: 250 Message accepted for delivery

Sample question

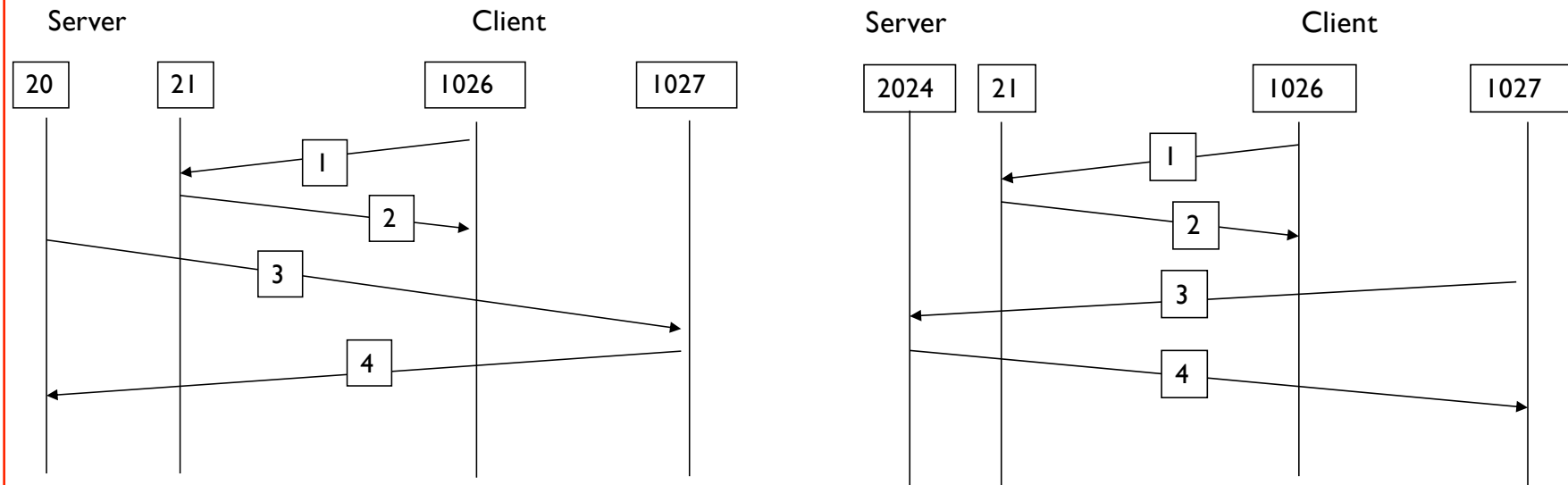
- Consider two cases of file transmission.



- Will it take longer time for the FTP client in case (a) to download a file?

Active FTP and passive FTP

- FTP is an unusual service in that it utilizes two ports, a 'data' port and a 'control' port.



- HTTP uses only a single connection for request and response.

Answer

- FTP requires a separate data connection be established for data connection.
- This implies that it could take longer time for a FTP client to start downloading a file from a FTP server in comparison to using HTTP.
- FTP is efficient in transferring big files.
 - No control message will be transmitted through data connection.
 - Using stream data transfer mode, data communication can be conducted very efficiently.
- Note: a properly tuned TCP layer would have more effect on speed than the difference between application layer protocols.

Sample question

- Explain how a FTP client can download several files simultaneously from a FTP server.
- Answer:

Things to note

- While it would be theoretically possible to make an FTP server support multiple, concurrent transfers, it's not supported by the RFC or any known implementation.
- The FTP server, after receiving a transfer request, does not return a final status or accept new commands until the data transfer is completed.
- Thus, though you could queue up another transfer request it wouldn't actually be processed by the server until the current one completes.