FIT9137
Introduction to Computer Architecture and Networks

Week 10: Workshop on Application Layer

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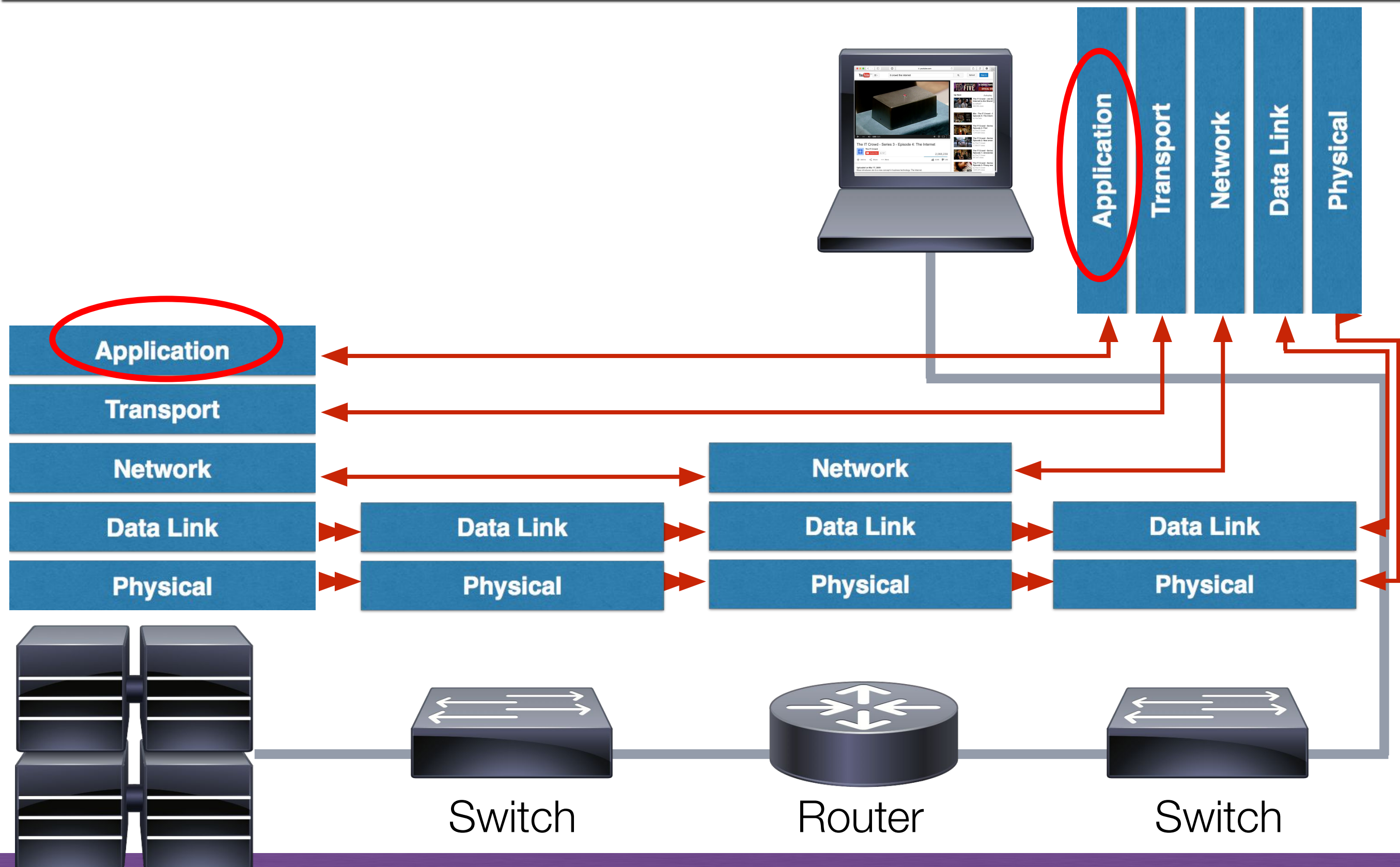www.shutterstock.com · 1322202464

Learning Outcomes

- Analyse between host-based, client-based, and client-server application architectures

- Appropriately parse and analyse the pages on the Web

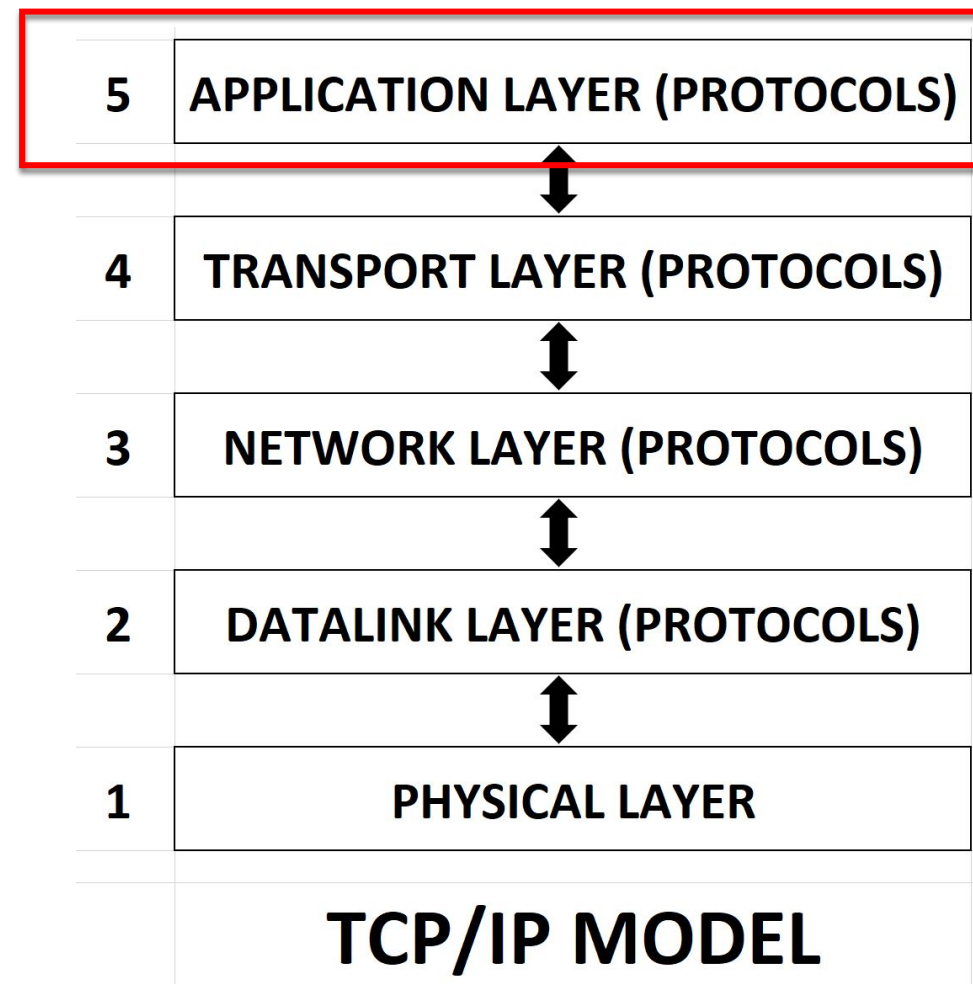- Analyse Email communication protocols

The

Application Layer

contains software that enables the

user to perform useful work.

This is software layer that provides the

business value.

Layers of Abstraction

Application
Transport
Network
Data Link
Physical

Application
Transport
Network
Data Link
Physical

Network
Data Link
Physical

Network
Data Link
Physical

Data Link
Physical

Switch

Router

Switch

World Wide Web

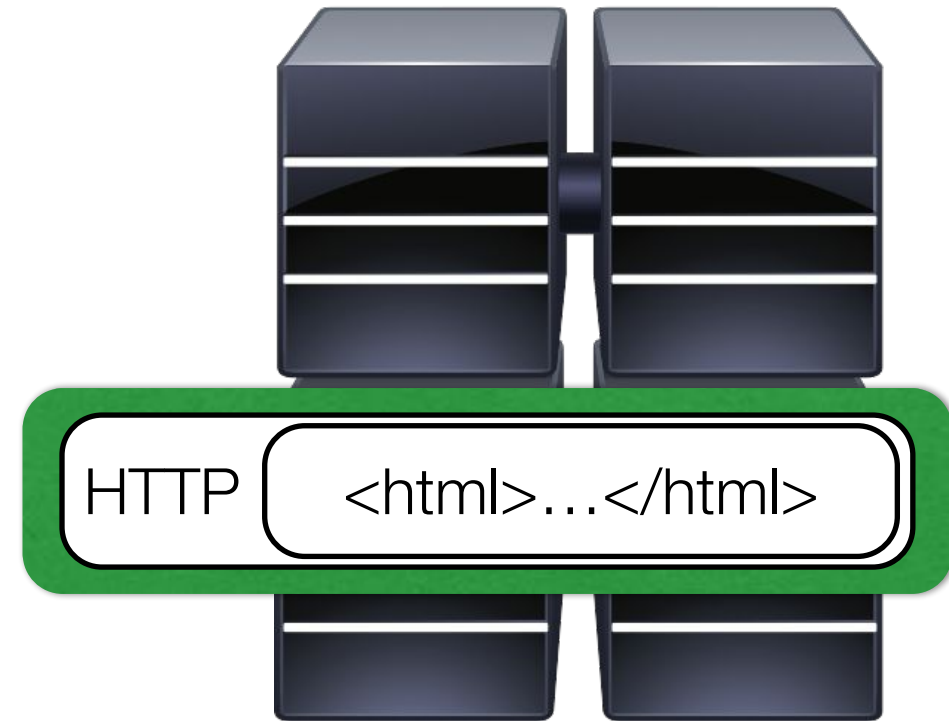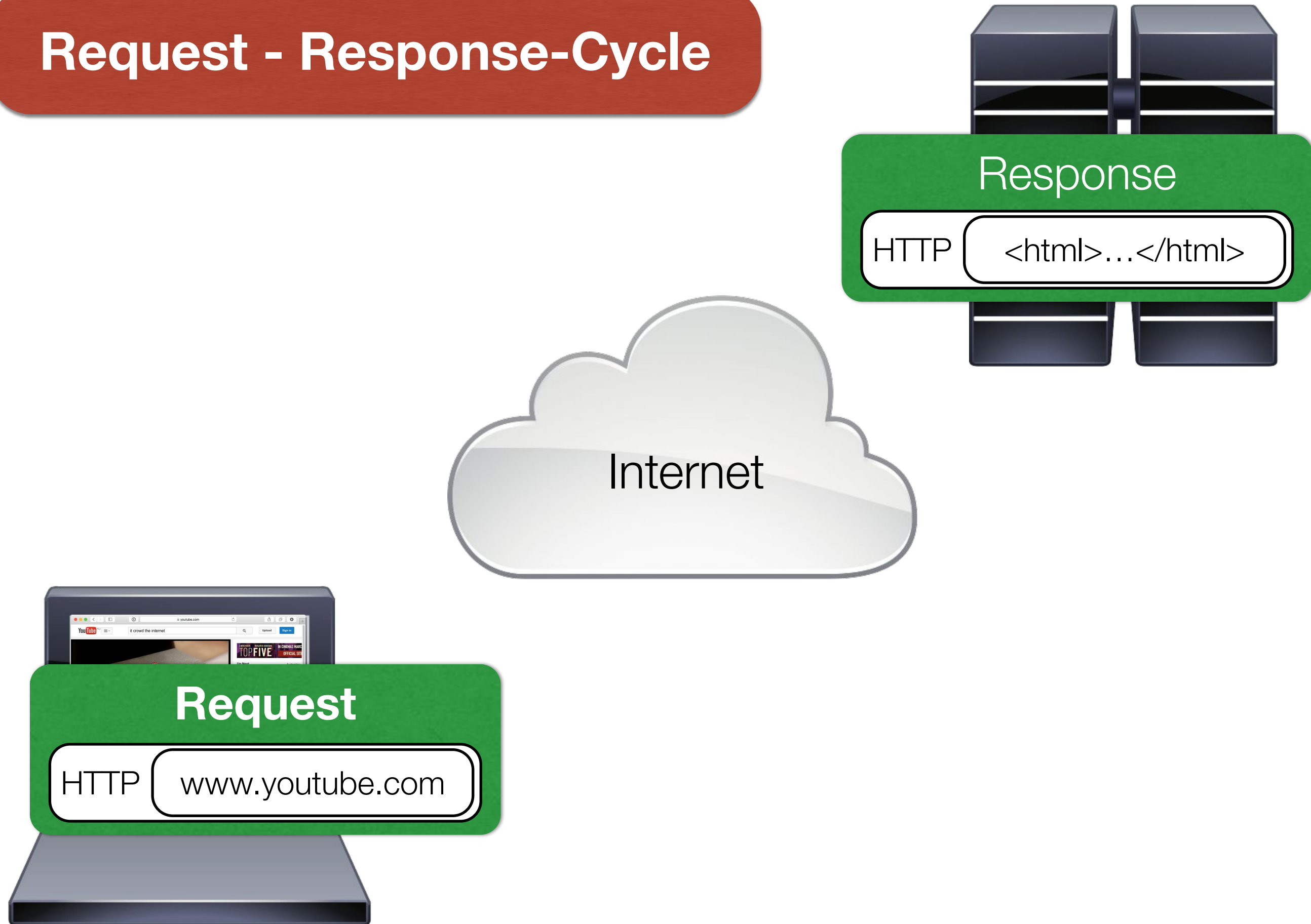|		
5	APPLICATION LAYER (PROTOCOLS)	
	↕	
4	TRANSPORT LAYER (PROTOCOLS)	
	↕	
3	NETWORK LAYER (PROTOCOLS)	
	↕	
2	DATALINK LAYER (PROTOCOLS)	
	↕	
1	PHYSICAL LAYER	

TCP/IP MODEL

WWW

- Based on **two main** technologies:

  - **HTTP** is the protocol for communication between browser and server

  - **HTML** is the format in which web pages are described

**What is HTTP?
What is HTML?**

HTTP `<html>…</html>`

Internet

HTTP `www.youtube.com`

Request - Response-Cycle

Response

HTTP <html>…</html>

Internet

Request

HTTP www.youtube.com

Basic HTTP session

client:

GET /~guidot/test.html
HTTP/1.1

Host: www.csse.monash.edu

Request line

Req. header

server:

HTTP/1.1 200 OK

Date: Thu, 05 Mar 2015 08:30:48 GMT
Server: Apache/1.3.26 (Unix)
Transfer-Encoding: chunked
Content-Type: text/html

Response status(http=status codes)

Response header

```
<html>
<body>
  <h1>Guido Tack</h1>
  <img src="images/guido3.jpg">
</body>
</html>
```

Response body

Activity A.1: We shall see the basic HTTP Interaction.

Basic HTTP session

```
<html>
<body>
  <h1>Guido Tack</h1>
  <img src="images/guido3.jpg">
</body>
</html>
```

client:

```
GET /~guidot/images/guido3.jpg HTTP/1.1
Host: www.csse.monash.edu
```

Basic HTTP session

client:

GET /~guidot/images/guido3.jpg HTTP/1.1
Host: users.monash.edu

server:

HTTP/1.1 200 OK
Date: Thu, 05 Mar 2015 08:31:23 GMT
Server: Apache/1.3.26 (Unix)
Last-Modified: Tue, 20 Nov 2012 03:29:22 GMT
Accept-Ranges: bytes
Content-Length: 15681
Content-Type: image/jpeg

JFIFHH@ICC_PROFILE0appl mntrRGB
…

HTTP Methods

- **GET**:
  Retrieve specified URL from server

- **HEAD**:
  Retrieve **only header** for specified URL

- **POST**:
  Add data specified in request body to specified URL

  E.g. add a message to a web forum, or an item to a shopping cart. Also retrieves document.

- Other methods (**PUT**, **DELETE**, **OPTIONS**…) less common

PollEv Question: Application

HTTP is called **_stateless_** protocol because _____ .

A. It has very basic architecture.

B. The server and client are aware of each other only during a current request.

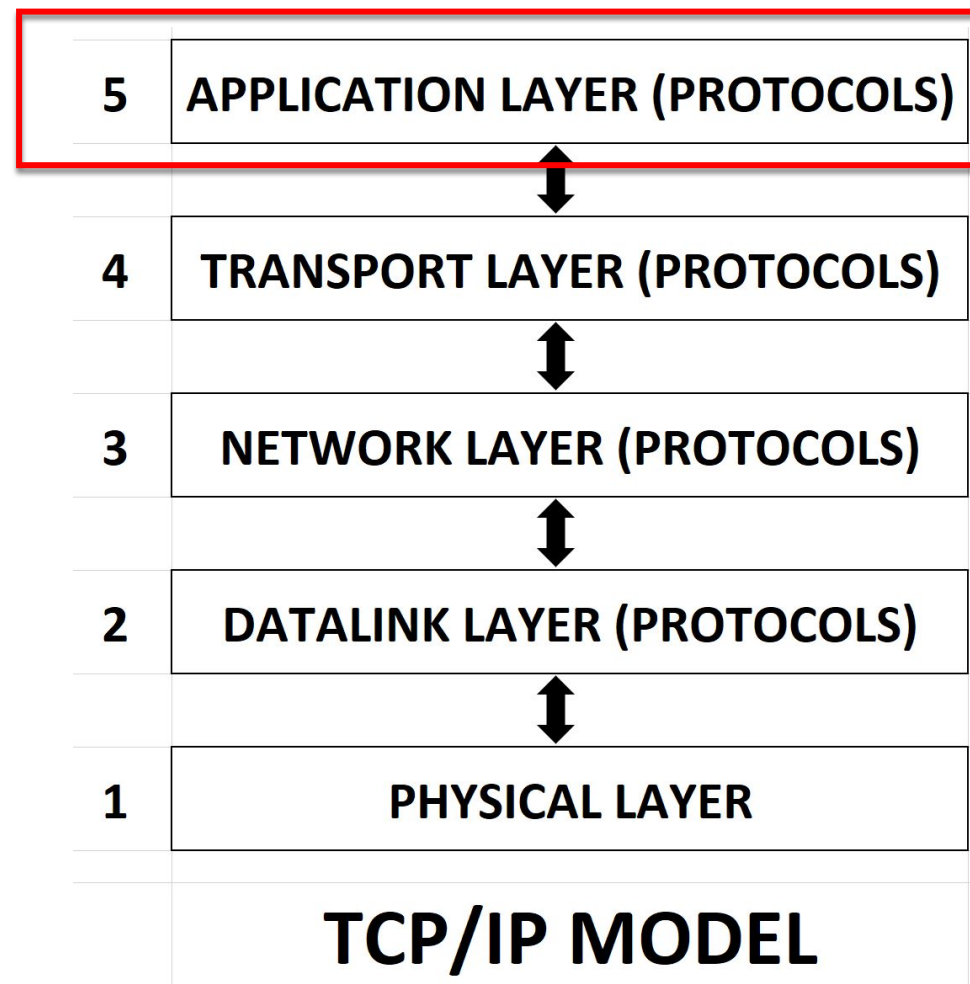C. Of longtime duration between client and server response time.

D. None of these options

PollEv Question: HTTP

The HTTP request line contains a _____ *method* to request a document from the server.

A. GET

B. POST
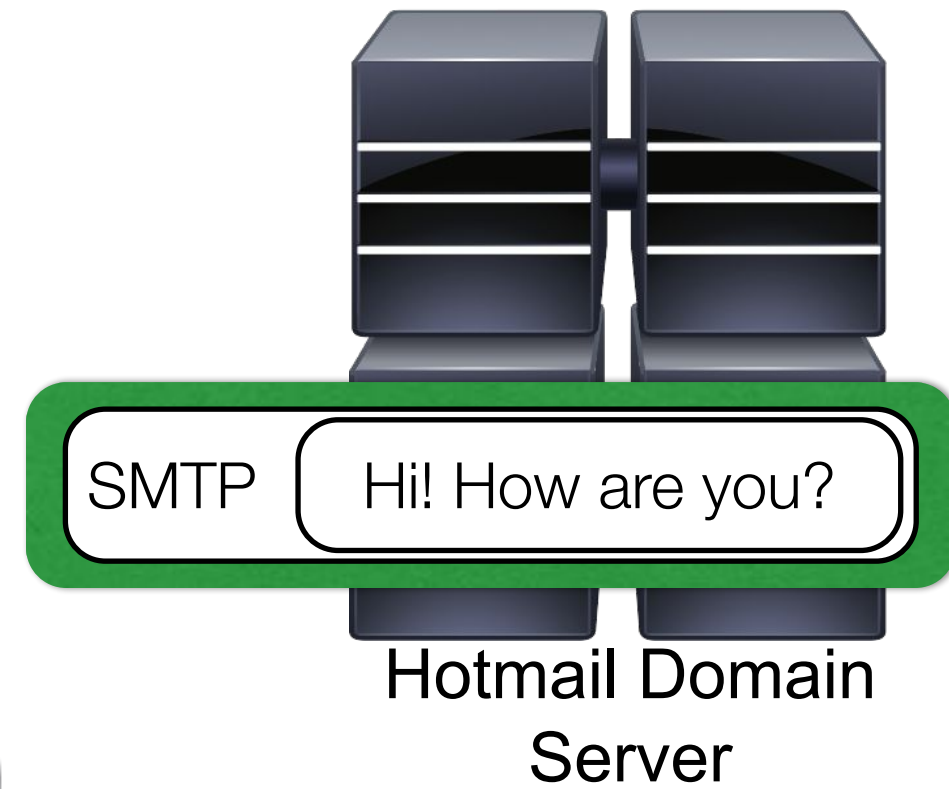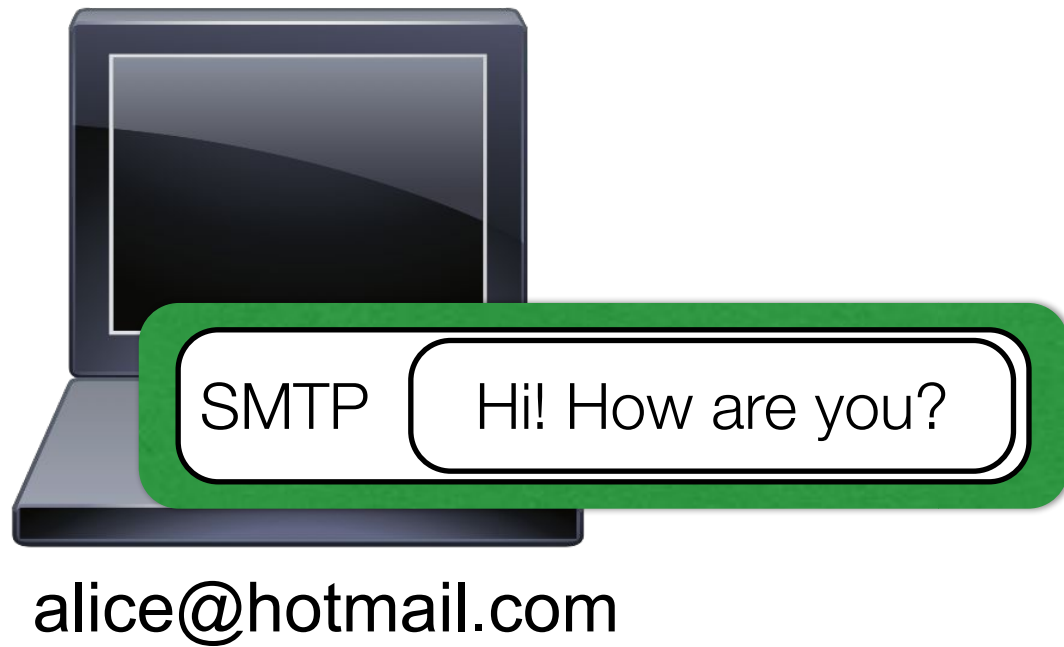
C. COPY

D. ACCESS

E. none of these options

ACTIVITY A

Electronic Mail

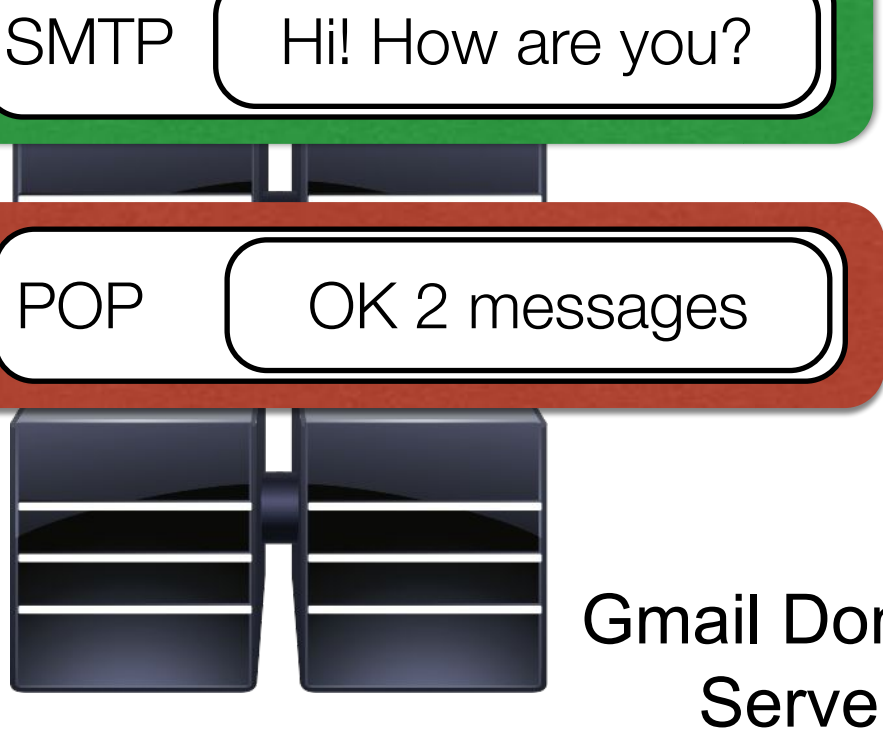|	
5	**APPLICATION LAYER (PROTOCOLS)**
4	**TRANSPORT LAYER (PROTOCOLS)**
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2	**DATALINK LAYER (PROTOCOLS)**
1	**PHYSICAL LAYER**

TCP/IP MODEL

Electronic Mail

- Invented in 1971 by Raymond Tomlinson

- That's before what we call the Internet!
  (it was called the ARPANET at the time)

- Key invention: name@server
  (address that separates the *user* from the *destination machine,* because machines were shared)

- Emails : Identifies the user @ a Domain Address.

  e.g., alice@hotmail.com, OR bob@gmail.com

SMTP — Hi! How are you?

alice@hotmail.com

SMTP — Hi! How are you?

Hotmail Domain Server

Internet

SMTP — Hi! How are you?

POP — OK 2 messages

Gmail Domain Server

bob@gmail.com

POP — LIST

alice@hotmail.com

SMTP

Hotmail Domain Server

smtp.gmail.com

SMTP

Internet

SMTP/POP/IMAP/

bob@gmail.com

Gmail Domain Server

Example SMTP Session

220 MyMailServer ESMTP Exim 4.82 Ubuntu Sat, 09 May 2020 20:37:24 +1100

HELO my.laptop

250 MyMailServer

MAIL FROM:<alice

250 OK

RCPT TO:<malik.kl

250 Accepted

DATA

354 Enter message

From: "Alice" <alice

To: "Malik Khan" <

Date: Mon, 09 May

Subject: test messa

```
S: 220 smtp.example.com ESMTP Postfix
C: HELO relay.example.org
S: 250 Hello relay.example.org, I am glad to meet you
C: MAIL FROM:<bob@example.org>
S: 250 Ok
C: RCPT TO:<alice@example.com>
S: 250 Ok
C: RCPT TO:<theboss@example.com>
S: 250 Ok
C: DATA
S: 354 End data with <CR><LF>.<CR><LF>
C: From: "Bob Example" <bob@example.org>
C: To: "Alice Example" <alice@example.com>
C: Cc: theboss@example.com
C: Date: Tue, 15 Jan 2008 16:02:43 -0500
C: Subject: Test message
C:
C: Hello Alice.
C: This is a test message with 5 header fields and 4 lines in the message body.
C: Your friend,
C: Bob
C: .
S: 250 Ok: queued as 12345
C: QUIT
S: 221 Bye
{The server closes the connection}
```

Reference: https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol

Hi Malik!

The formal protocol that defines the Mail Transfer Agent (MTA) - client and server on the Internet is called _____.

A. SMTP

B. SNMP

C. TELNET

D. none of these options

PollEv Question: Spam

Spam = "Unsolicited Bulk Email"

Estimates: **between 50% and 70% of all emails are spam**

How would you solve this problem?

ACTIVITY B

Research the following:

1. DKIM
2. PGP
3. S/MIME