Intellectual Property rights

December, 2023

Doha, Qatar

This content is produced by the team of
National Cybersecurity Excellence Management, National Cyber Security Agency.

For inquiries about the initiative or program, you can contact us through the following websites or phone numbers:

الوكالة الوطنية للأمن السيبراني
National Cyber Security Agency

🌐 https://www.ncsa.gov.qa/

✉ cyberexcellence@ncsa.gov.qa

▫ 00974 404 663 78

▫ 00974 404 663 62

Time Table for the Lecture

Content	Allocated Time
General introduction	5 minutes
The theoretical aspect	25 minutes
View Educational Videos	25 minutes
Short break	20 minutes
Implementation of Training games	25 minutes
Dialogue and discussion with students	15 minutes
Graduation project	5 minutes
Workshop duration	2 hours

Content of The Training Kit

Chapter 1

The Concept of the

Protocol IMAP4

The importance of protocol IMAP4

It is a protocol for accessing messages over the Internet, which is a program used to retrieve incoming email, by storing mail messages on a remote server away from users, where it allows them to view and manage messages as if they were stored on their personal device.

The IMAP4 protocol enables users to organize email messages in folders, mark messages for follow-up, and save message drafts on the server. Users also benefit from the features of this protocol by displaying read or unread messages.

IMAP4 acts as an intermediary between the email server and email users, by reading messages through this protocol outside the server without the need to download or store mail messages on their personal devices, which means that email is not linked to a specific device, but users can access it from anywhere in the world using different devices such as desktop computers, laptops, smartphones, and tablets.

Access to email messages from multiple devices.

Quick and efficient access to email messages.

Supporting email functionalities, such as search and sorting.

Advantages of IMAP4 protocol:

Multiple users can share a mailbox.

the users by it can organize email messages.

Advantages of IMAP4 protocol:

Displaying unread emails in the inbox.

Ideal for those who need to access their email while traveling or using different devices.

Eliminating the need to re-download messages when transitioning between devices as they are stored remotely.

Directly handling messages on the email server, instead of downloading them to the user's device.

In IMAP4 protocol, providing email presence on the server ensures higher security in case the user loses or damages their device whether it is a phone or a computer..

The difference between protocol and the rest IMAP4 of the protocols followed in email

Email protocol

An email protocol is a program that connects one computer to another to exchange email messages.

When sending an email, there are three elements in the exchange equation (two devices + server) ; One of the devices sends the email to the other (the recipient), while the mail server's task is to store the messages and allow the receiving device to access and download them when needed.

There are four different mail protocols, in terms of features, uses and importance, which are: POP3, IMAP4, SMTP, and HTTP.
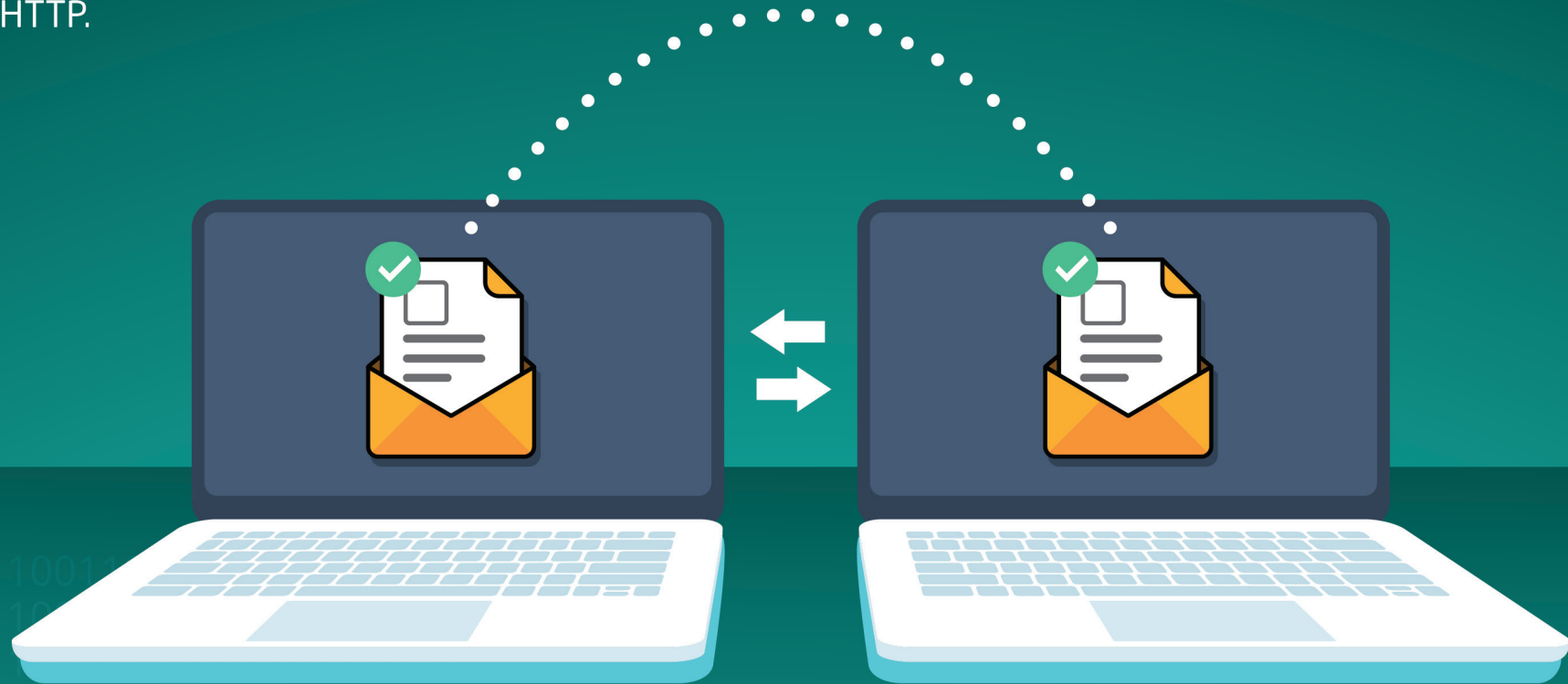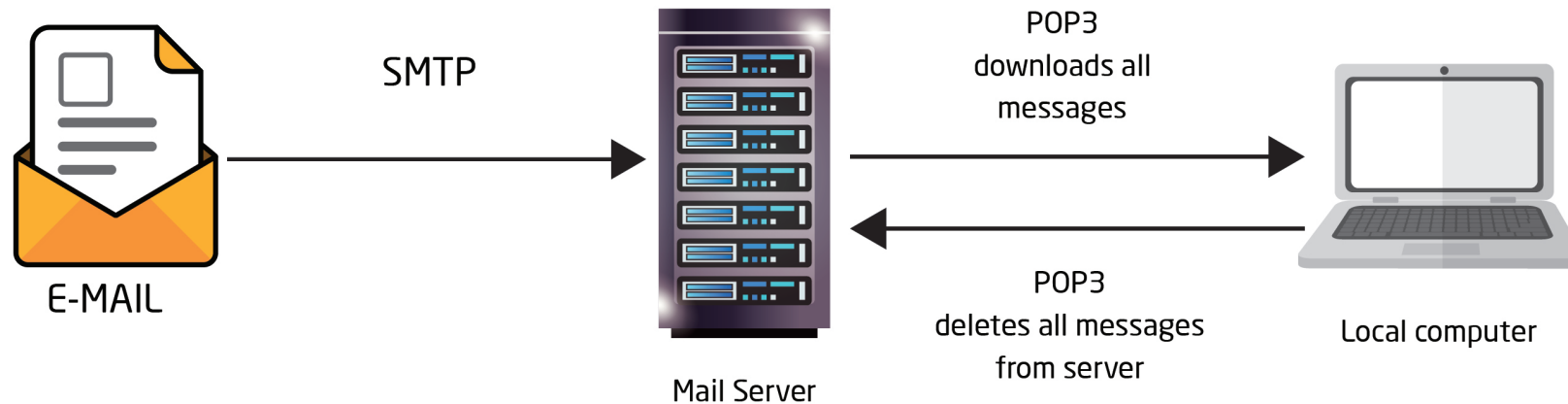
Illustration of how POP3 works.

POP3 protocol

POP3 is a simple and old protocol designed for use on a single computer, supporting only one-way email synchronization, which means allowing users to download email messages from the server to the client only on their own computer.

POP3 enables email users with temporary internet access to access their messages, read them, or compose new messages or reply to them even if they are not connected to the internet, and then send them when they reconnect to the internet. Examples of this type of email protocol include Yahoo.

Disadvantages of POP3 protocol

Marking messages as read on multiple devices, which means that every time the user downloads a message from his email on a different device, it will appear as a new message.

1

Incapable of synchronizing sent items.

2

Users must continually set up their device to periodically check their email server to recognize newly received messages.

3

Users need to manually create items like personal folders or adjust settings individually on all devices.

4

Advantages of POP3 protocol:

- Ability to store mail on devices.

- Access to mail without internet connection.

- Provides space saving for users by deleting messages after downloading.

- Users can leave copies of their email on multiple POP servers.

- Users can consolidate multiple email accounts into one mailbox.

- Data is more secure because no email is stored on the POP server.

IMAP4 (Internet Message Access Protocol)

The IMAP4 protocol supports users' access to their email messages, whether they are connected to the internet or not, similar to POP3 protocol. It also allows users to download email messages to their personal devices while keeping a copy on the server, and that copy available on the server is considered the original version of the message.

Advantages of IMAP4 protocol:

Saving time for email users as it allows them to search for email messages on the server.

Ability to create new mailboxes that appear as folders on the server and move messages between folders.

Allows logging in through multiple email users on computers or mobile devices and reading the same messages.

Ability to synchronize all changes made across multiple devices.

The sent, received, and stored email on the server cannot be deleted except by the user.

Illustration of how IMAP4 works.
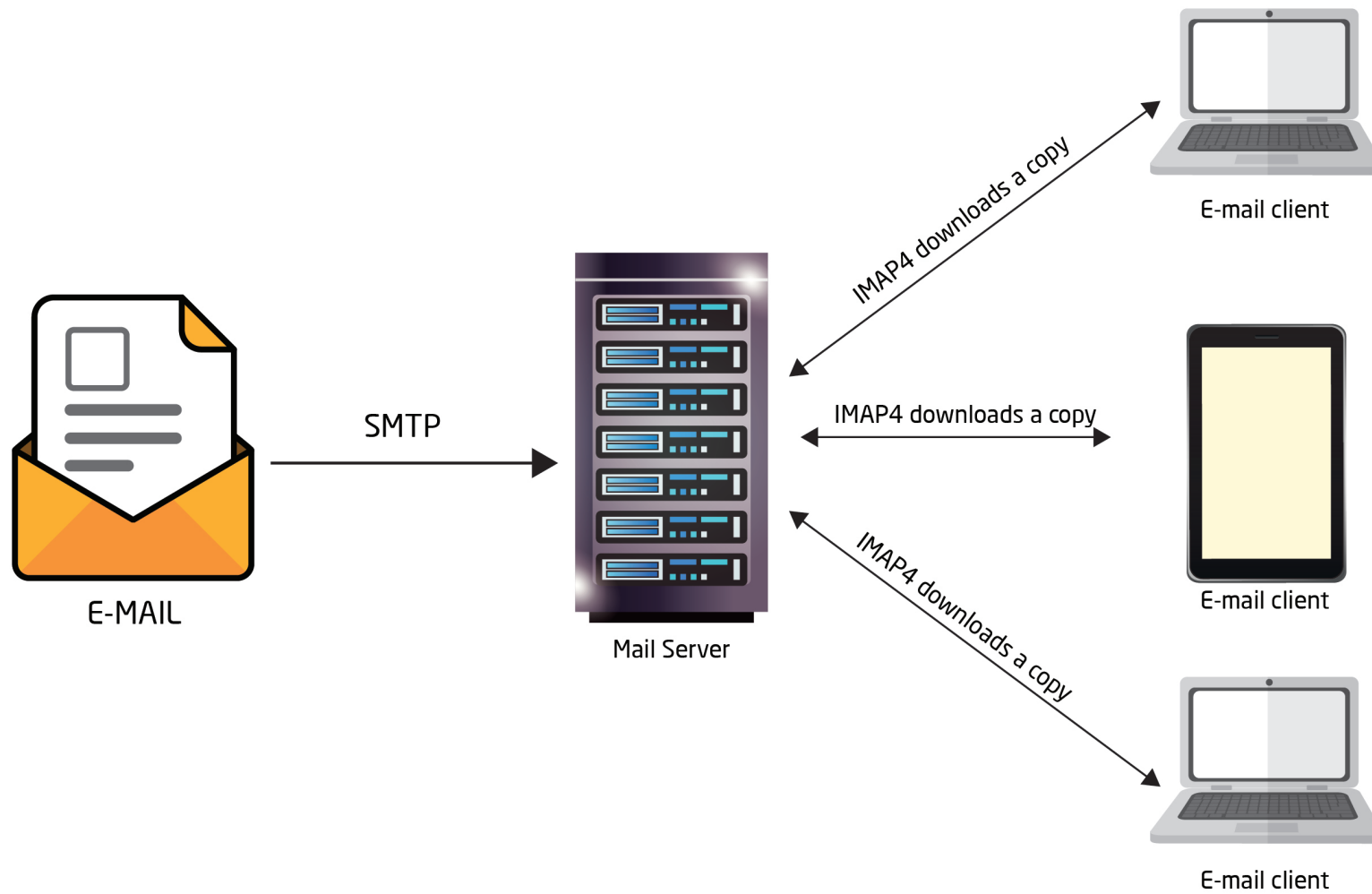
Disadvantages of IMAP4 protocol:

- Limiting message storage to 200 MB or 500 MB unless you purchase more professional email services.
- keeping all messages on the server increases the chances of E-mail theft and Hackers' access to it, especially if the user's password is insecure or weak.
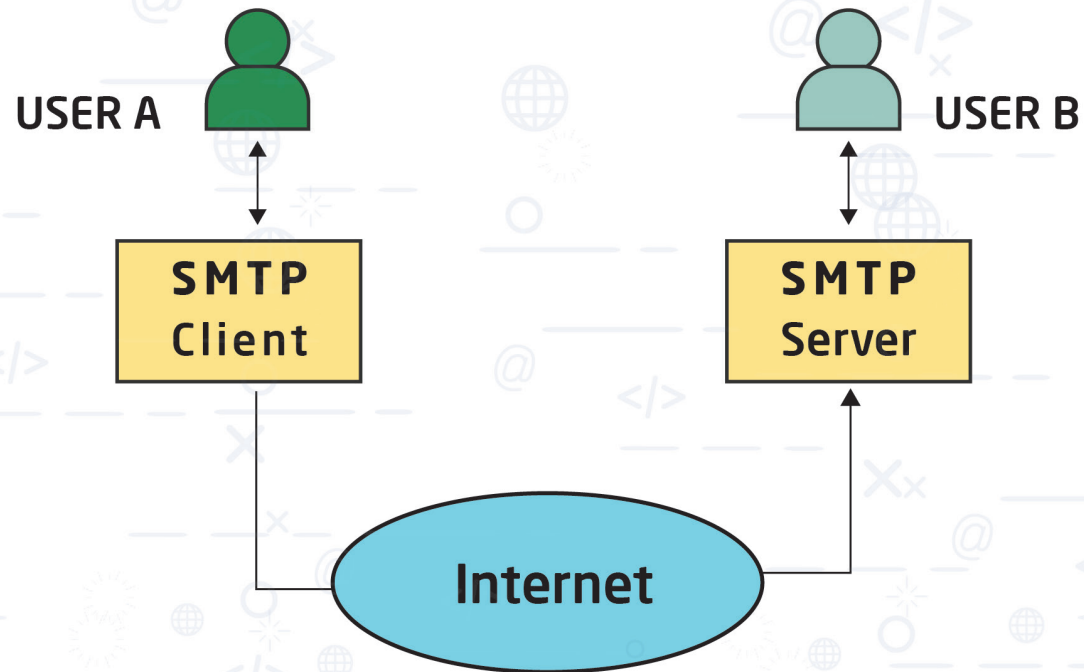
Illustration of how SMTP works.

SMTP (Simple Mail Transfer Protocol)

It is a simple text-based protocol that works well when devices are connected to each other, and it only specializes in sending email messages unlike POP3 and IMAP4 protocols, which provide message retrieval from the server, and this is the reason behind the decline in reliance on it, and to overcome this drawback SMTP protocol provides the possibility of placing email messages in a queue on the server.

Disadvantages of SMTP

1. **Lack of security feature:** as it is easy to hack.

2. **Server restrictions:** The protocol sets several rules for hosting, as well as restrictions for internet connection.
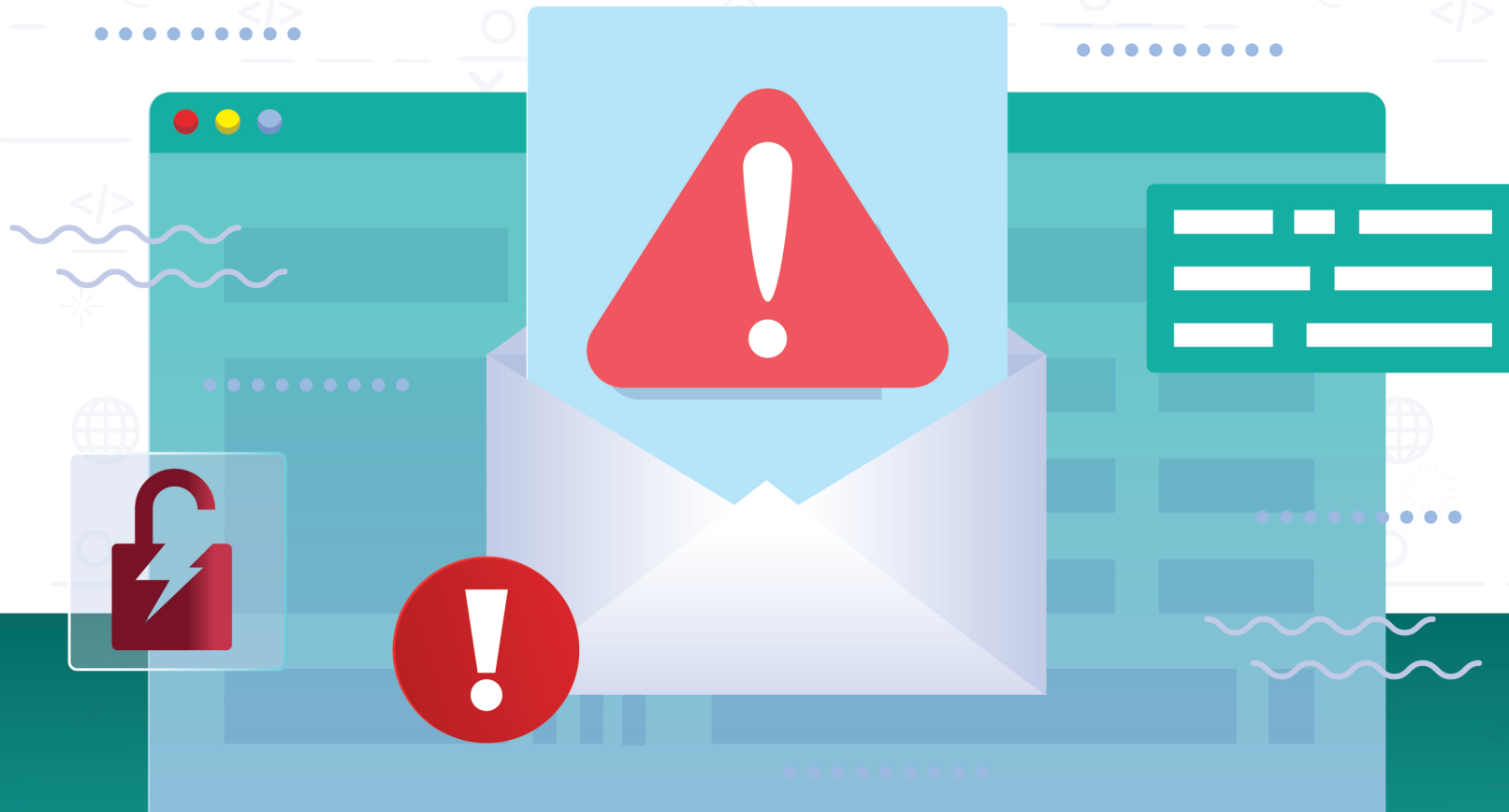
Advantages of SMTP

1 Ability to perform statistics from the sent messages to create statistical reports for sent newsletters.

2 SMTP Enables synchronization of Smarthost server.

Hypertext Transfer Protocol (HTTP)

- HTTP plays an important role by allowing internet browser users to access their mail messages, whether for sending or receiving. And among the most famous applications that use this protocol are Hotmail and Yahoo.

- HTTP (Hypertext Transfer Protocol) is used to access data on the World Wide Web (www), where it can be used to transfer data whether as plain text or audio or video and more.

- This protocol is characterized by its efficiency in moving between documents quickly, as well as delivering messages instantly.

There are two types of HTTP messages:

Request message
1

The user sends a message consisting of a request line, headers, and sometimes text.

Response message
2

The server responds to the user with a message consisting of a status line, headers, and sometimes text.

Advantages of HTTP protocol:

Connectionless protocol.

Both the user and the server know each other only during the current request, and therefore neither of them retains information about the requests.

Reducing access time in communication.

Storing all HTTP pages within what is known as "page cache memory" on the internet upon first visit, which makes loading content faster when visiting pages again.

Data can be sent as long as both the user and the server know how to interact with the data content.

HTTP uses an advanced system for addressing files, making it easy to identify them on the web, which makes using the public easier with the internet.

It provides the ability to download plug-ins and display relevant data, such as flash players and Acrobat reader (PDF files).

An illustration of how the request and response are exchanged between the user and the server.

This is a request.

This is a response
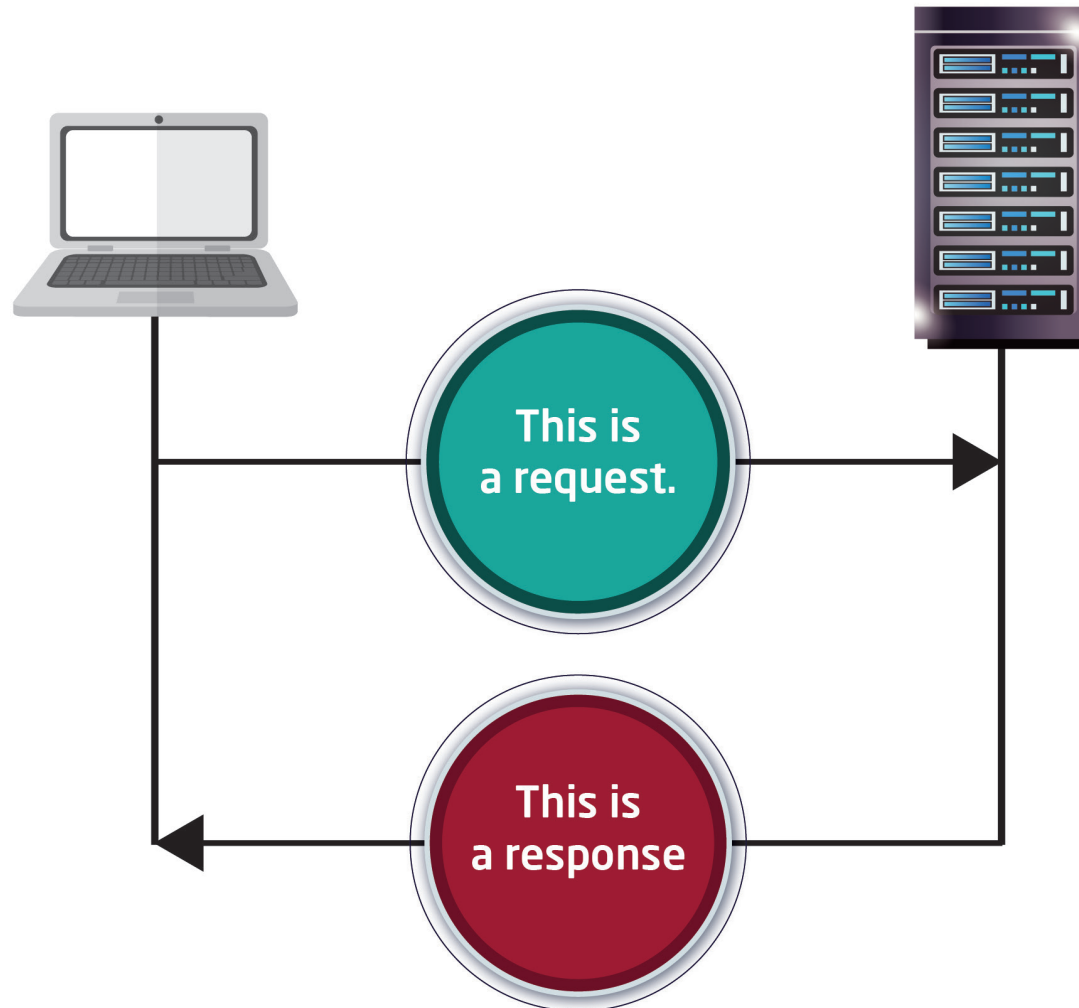
Disadvantages of HTTP protocol:

Data integrity: Due to the absence of encryption methods in the HTTP protocol, the chances of content manipulation increase, making it an insecure choice for data.

1

Data privacy: One of the disadvantages of HTTP is the issue of privacy, where any intruder can intercept the request and display the content on the web page, as well as collect confidential information such as username and password.

2

HTTP requires multiple connections to transfer a web page, which means more administrative costs.

3

Clients fail to take actions to close the connection despite receiving all the required data from HTTP.

4

HTTP consumes more energy due to its increased usage of system resources; therefore, it is not the best option for Internet of Things devices.

5

Chapter Two

How IMAP4 Protocol Works

The main purpose of the IMAP4 protocol

Is to provide users with a convenient and efficient way to access, manage and organize email messages stored on the mail server.

How does IMAP4 protocol work?

01 **Connecting to the server:** To access the user's email, they must connect to their mail.

02 **Authentication:** In this step, the user inputs their contact information (username and password) to the server, which verifies and authorizes these data

03 **Synchronization:** Once the user accesses their email, they retrieve the list of messages and folders from the mail server, allowing him to synchronize between both parties.

04 **Accessing messages:** When the user requests to read email messages, the IMAP4 protocol begins transferring only the necessary parts of the email.

05 **Processing messages:** The user can perform several operations on their emails.

06 **Disconnecting:** The connection with the server is cut off once the user finishes using the mail.

Security concerns for IMAP4

Despite the advantages of protocol, there are some security concerns that may occur through it, such as:

1 Increased risk of sensitive information exposure to eavesdropping or external attacks.

2 In case of a breach, intruders' gaining access to messages becomes inevitable, leading to privacy violation and data theft. Hence, it's advisable to employ two-factor authentication should be used, along with strong and different passwords that are difficult to guess.

Mechanism of accessing email messages and IMAP4 protocol

How email works

Email

Email is an electronic communication method for sending and receiving messages over the internet, currently the most common form of communication. It features functionalities like synchronization and security, as well as features related to spam emails.

Email consists of:

1 **Sender:** The person who sends an email containing information with the aim of delivering it to the recipient.

2 **Recipient:** The receiver who obtains the information sent by the sender via email.

3 **Email address:** It is the address on which the sender and recipient communicate similar to receiving physical mail at home.

4 **Mailer:** This program ensures the possibility of reading, writing, managing and deleting emails in email such as Gmail, Outlook and others**.**

5 **Mail server:** It is responsible for sending, receiving, managing and recording all data that is done by its own email programs, as **.**well as processing them

6 **SMTP:** It is a simple mail transfer protocol that uses the Internet to send and receive messages.

7 Following this, the Internet Message Access Protocol (IMAP4) is used by the email user (the recipient) to retrieve the sender's message from the mail server and place it in his inbox.

How email works

1 When the sender uses mail, it is redirected to Simple Mail Transfer Protocol.

2 The protocol stores the sent email on the server for later transfer using any of the basic protocols POP or IMAP4.

3 In case the recipient has a different domain address (for example, the sender's domain Gmail differs from the recipient's domain Hotmail), then SMTP protocol connects with Domain Name Server (DNS) which communicates with the other address used by the receiver and then the sender's SMTP connects with the recipient's SMTP to deliver the email.

4 If both SMTPs of sender and recipient are unable to communicate with each other due to internet issues, then the email is placed in a specific SMTP queue until the problem is resolved. However, if the issue persists, the message is returned to the sender.

5 When the recipient uses the POP3 protocol, the received email is deleted from the web server. However, if using IMAP4, the email is stored on the web server for the recipient to manage at any time.

Exercises and training
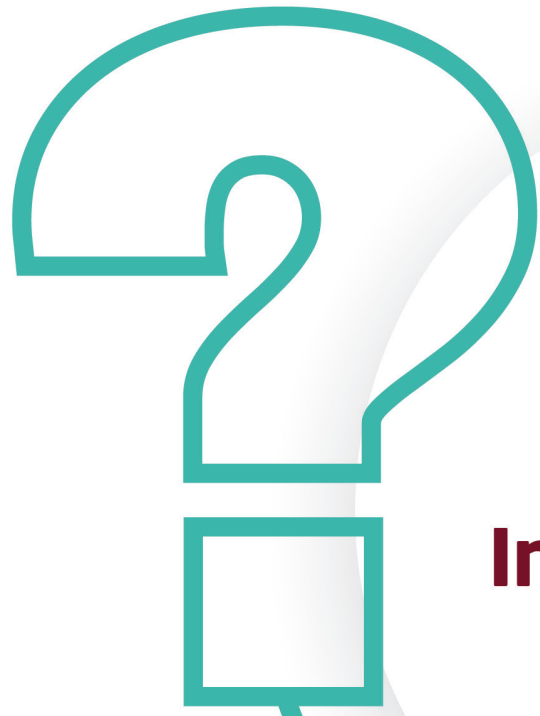
First:
In-Class Exercises
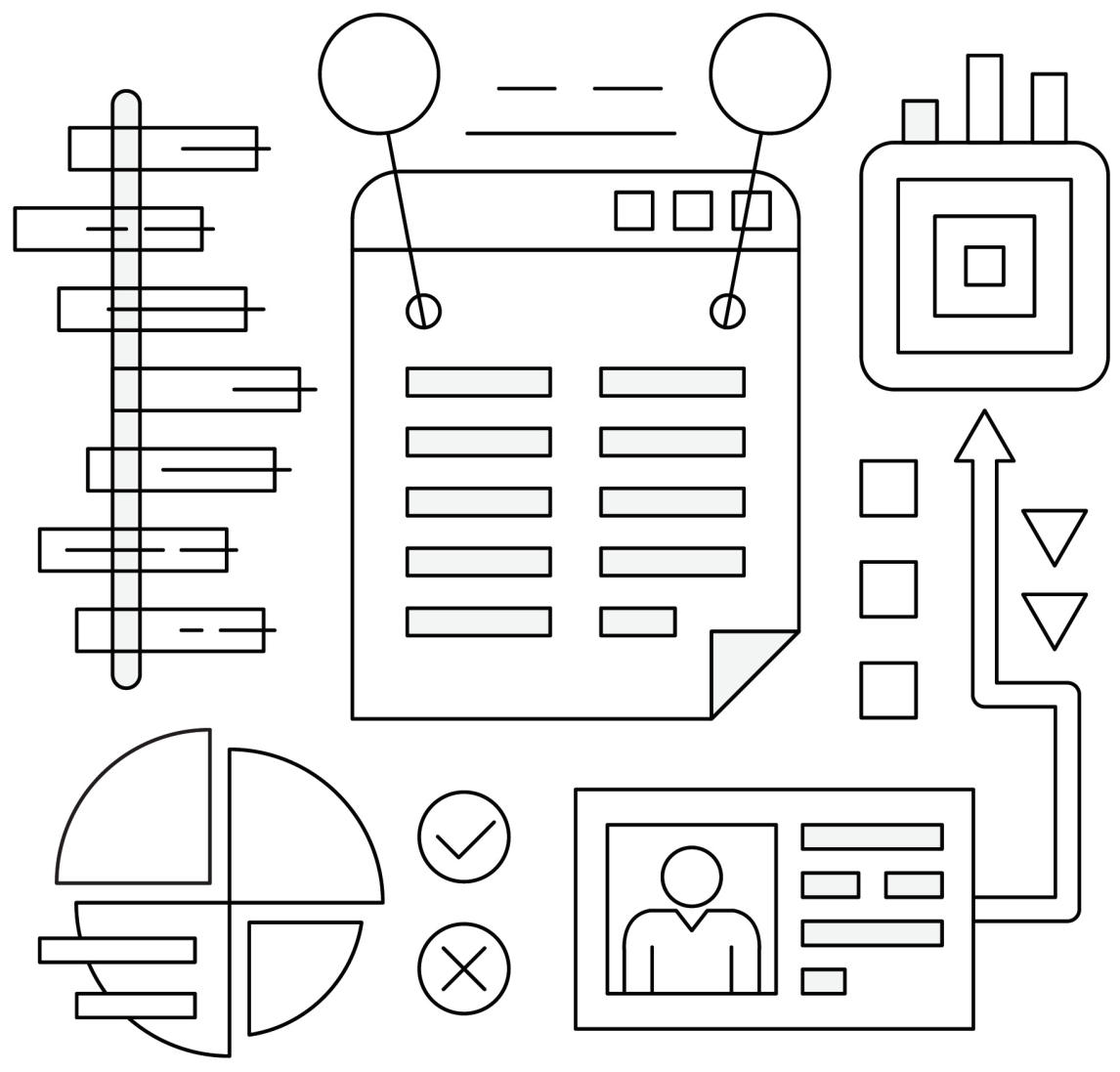
Pay Attention!

(IMAP4)

IMAP4 stands for Internet Message Access Protocol. It is a program that is used to access incoming email. It stores email messages on a remote server, away from users, and then allows them to view and manage messages as if they were stored on their personal computer.

Pay Attention!

The (IMAP4) protocol allows users to organize email messages into folders, mark messages for follow-up, and save draft messages on the server. Users can also take advantage of the protocol's features to show messages that have been read or that are still unread.

Exercise 1
Complete the following sentences

1. Email is a means of exchanging digital **messages** through **the internet** or interconnected networks.

2. Instant messaging means the transmission of _____ at the same time of sending them, while _____ relies on _____ and forwarding, and _____ messages can be saved in mailboxes for users to access at any time.

3. A protocol is _____ rules and sending regulations that _____ a particular process and using these _____ enables us to organize the process of _____ of email messages between users.

4. There are three basic protocols currently in use, which are the SMTP system, the POP3 system, and the _____ system.

5. The _____ protocol is used for sending _____, while the _____ and _____ are used for receiving email _____.

Pay Attention!

The (IMAP4) protocol acts as an intermediary between the email server and the email user. This is done by reading the messages through the protocol outside of the server without the need to download or store email messages on their personal devices.

Instructions:

Read the sentences in the table carefully, start with the first sentence in column (A), and search in column (B) for the sentence that completes its meaning. Below is an example of the connection between two sentences.

Exercise 2

Match the terms from column (A) with their corresponding meanings in column (B):

Column (A)	Column (B)
IMAP4	The latest and specialized in receiving messages
The IMAP4 protocol is used for	Keeping messages in email without deletion
The IMAP4 protocol allows users to	Receive messages
The IMAP4 protocol helps with	Internet Message Access Protocol 4
The IMAP4 protocol is considerd	Accessing the server and selecting the messages to be read
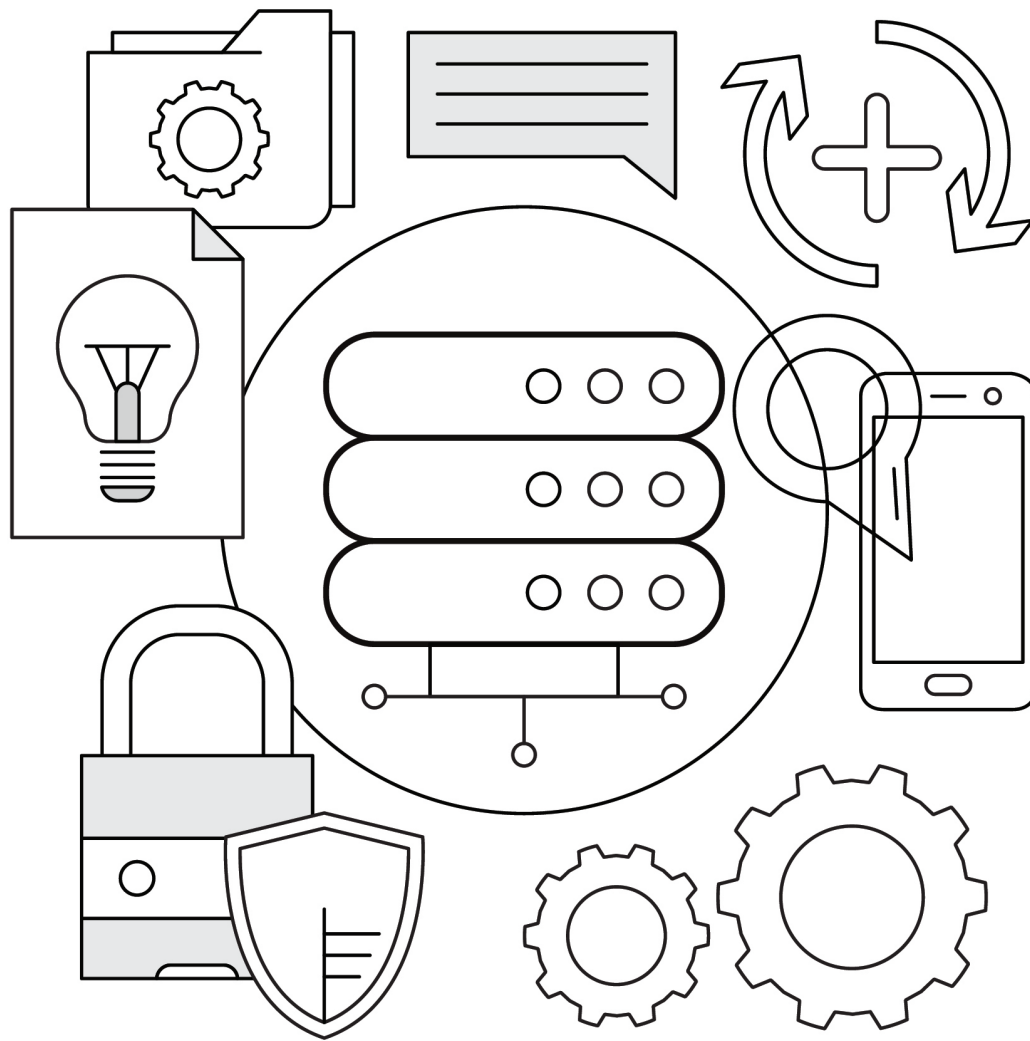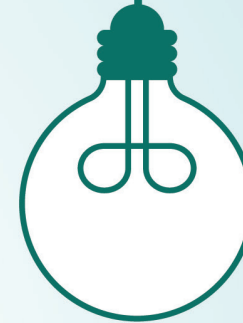
Do you know that...?

There are two types of HTTP messages: the request message and the response message.

Pay Attention!

Email Protocol

An email protocol is a program that connects one computer to another to exchange email messages.

Exercise 3

Mark (✅) or (❌) in front of the following sentences:

1. One of the important features of the IMAP4 protocol is that it allows users to access text messages. ⬭

2. The IMAP4 protocol acts as an intermediary between email servers and email clients. ⬭

3. The IMAP4 protocol saves you the trouble of downloading email messages from the server to the email client. ⬭

4. The IMAP4 protocol allows users to access their email from any device. ⬭

5. The IMAP4 protocol automatically updates itself when the user makes any changes to the files on the email. ⬭

6. Users cannot access their email accounts when using a different device. ⬭

7. The IMAP4 protocol and other protocols work to divide technical processes, preventing computers and servers from connecting to each other. ⬭

8. The IMAP4 protocol is used to send email messages. ⬭

9. The IMAP4 protocol is a paid protocol. ⬭

10. You can only use the IMAP4 protocol on one device without others. ⬭

Pay Attention!
Email Protocol

When sending an email, there are three elements in the exchange equation (two devices + server) ; One of the devices sends the email to the other (the recipient), while the mail server's task is to store the messages and allow the receiving device to access and download them when needed.

Exercise 4

Complete the following sentences

1 The main feature of IMAP4 is that it ......**allow**...... users to access their **electronic** mail ......**messages**.... from ......**another**.... device

2 The IMAP4 protocol acts as an intermediary between the email .... and the email .... , instead of .... email messages from the server to .... client.

3 Through the .... protocol, users can access their email .... from any different .... without any problem.

4 IMAP4 protocol users do not need to connect to the same .... where they originally read the ....

5 The IMAP4 protocol is used for .... email messages.

Instructions:

Carefully read the sentences in the table and determine whether each sentence refers to the IMAP4, SMTP, or POP3 protocols. An example provided below

Exercise 5

Identify which of the following sentences relate to the **IMAP4** protocol and which ones belong to the **SMTP** and **POP3** protocols:

	Protocol Type
1. You can access your email messages from any device.	**IMAP4**
2. Used to transfer simple mail from a local client to the recipient's address.	
3. Email messages can only be accessed from the device they were downloaded on.	
4. Email messages cannot be accessed in offline mode.	
5. Works in conjunction with MTA software to transfer messages to the right destination.	
6. Messages are downloaded into the device, which takes longer to display messages.	
7. Once downloaded, email messages are deleted from the server.	
8. The server stores email messages as intermediaries between the server and the client.	

	Protocol Type
9. Protects devices by filtering messages.	
10. Subject lines and sender names are quickly filled in email.	
11. The number of messages an account can send within a specific timeframe is regulated.	
12. Email messages can be accessed in offline mode.	
13. Message groups are not downloaded until the user clicks on them.	
14. Preserves the same storage space for emails by automatically deleting messages.	
15. Requires more server space as it does not automatically delete messages.	

Pay Attention!

Email is an electronic communication method for sending and receiving messages over the internet, currently the most common form of communication. It features functionalities like synchronization and security, as well as features related to spam mail.
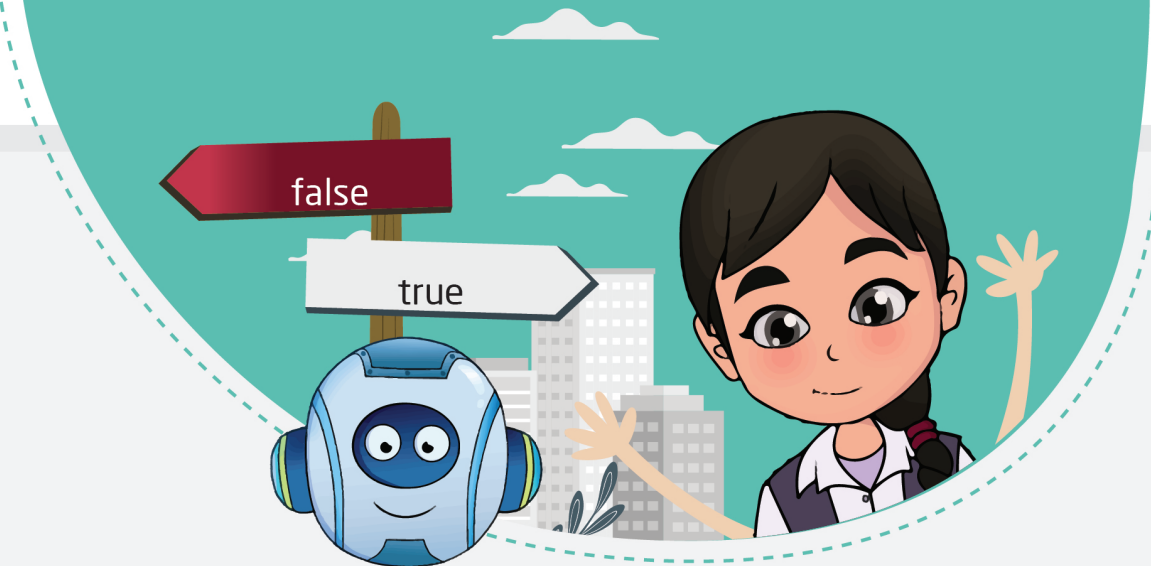
Exercise 6

Identify the true and false statements in the following sentences:

#	Statement	
1	Users can access and read their email from any device.	**false**
2	Users can open email messages even when not connected.	
3	When a user logs into their email, the email server retrieves all their email messages.	
4	Email users cannot see any data related to the email until they open a message.	
5	Email deletes old messages periodically.	

Second:
Non-classroom Exercises

Pay Attention!

POP3

POP3 is a simple and old protocol designed for use on a single computer, supporting only one-way email synchronization, which means allowing users to download email messages from the server to the client only on their own computer.

IMAP4 Protocol

POP3 Protocol

SMTP Protocol
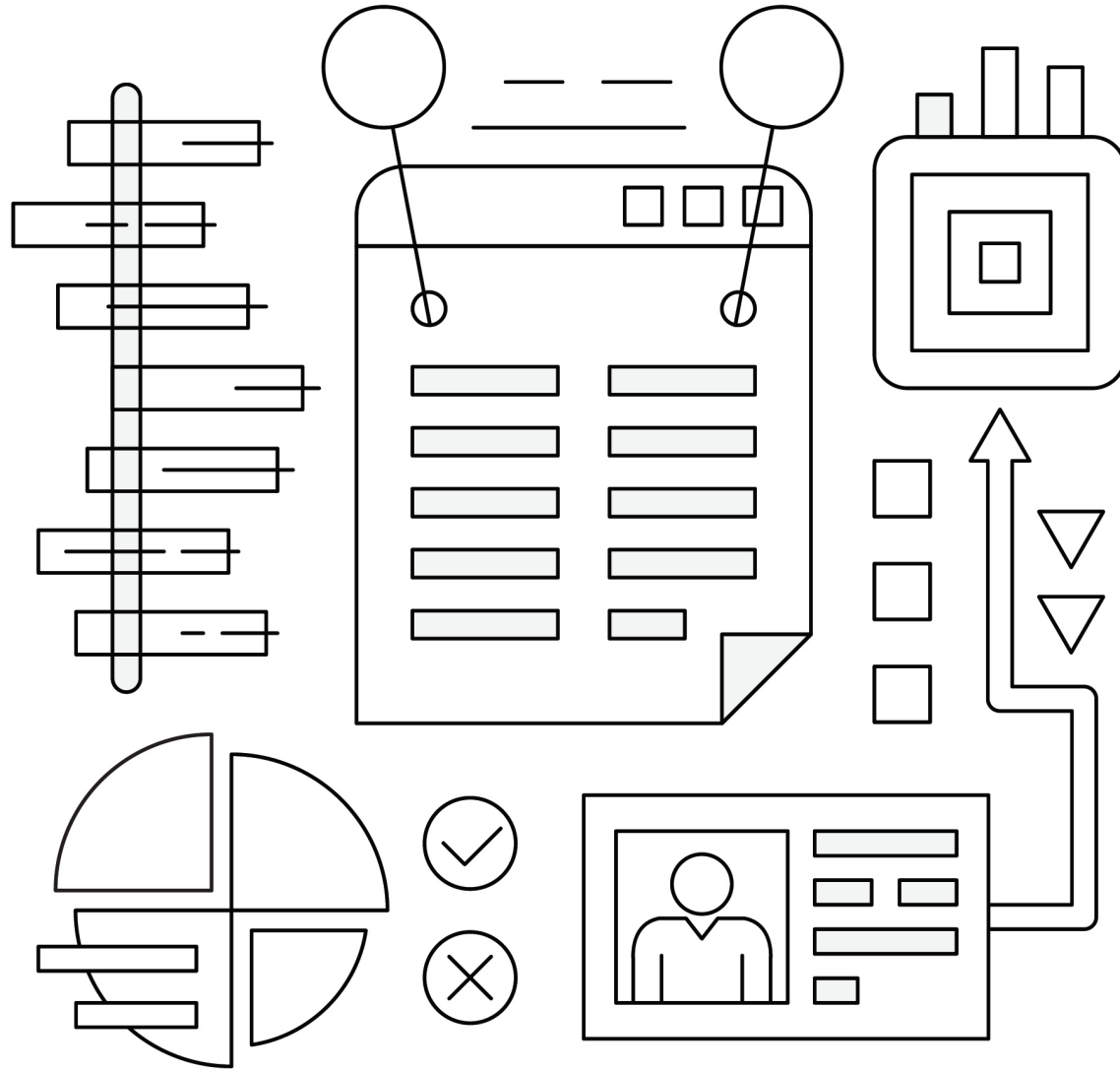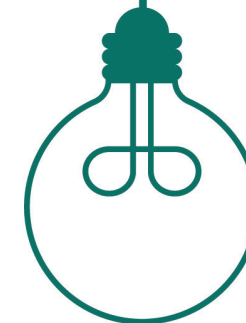
Do you know that...?

All HTTP pages are stored in what is known as the page cache on the internet when you visit them for the first time, which makes loading the content faster when you visit the pages again.
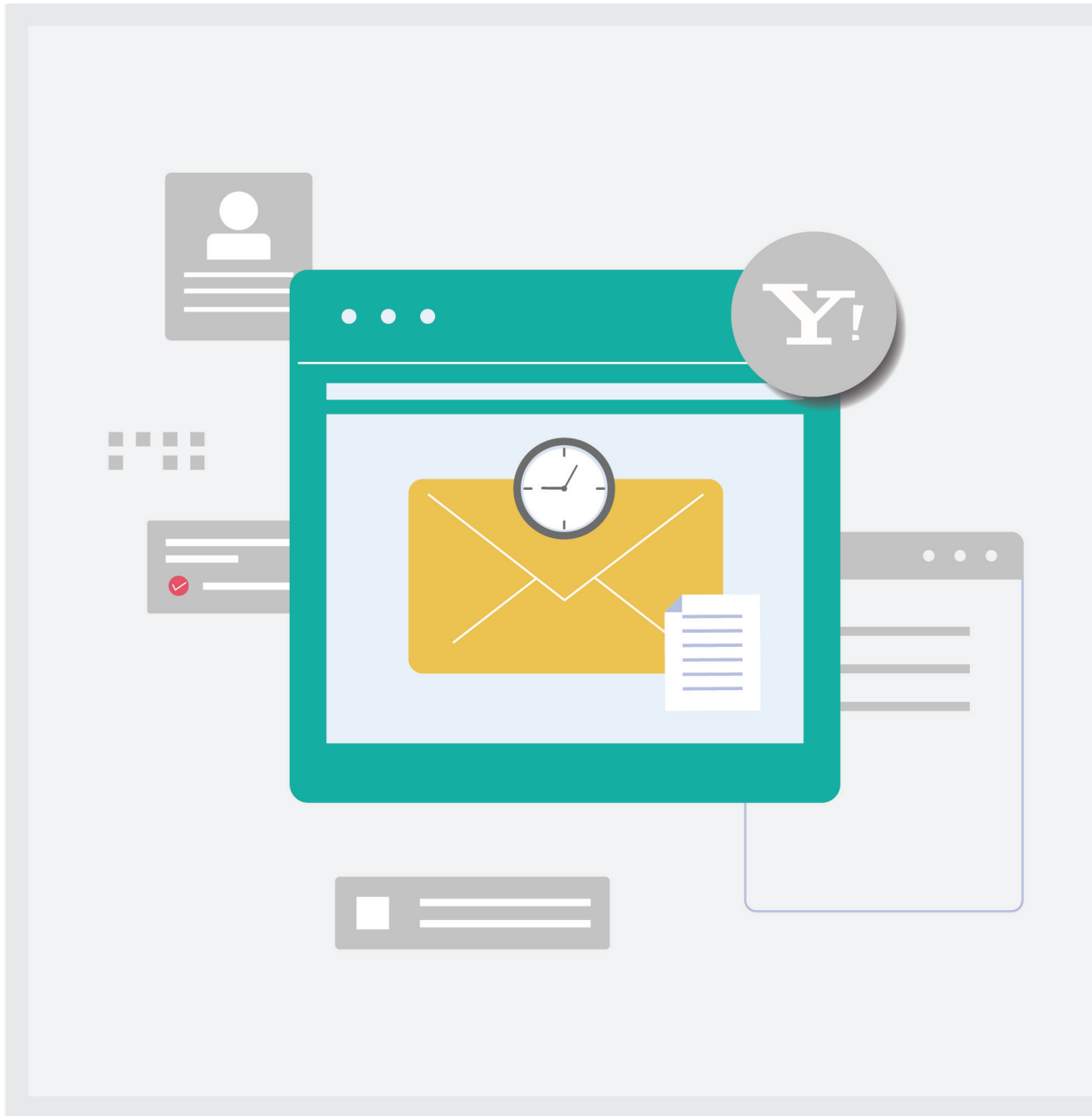
Pay Attention!

POP3 enables email users with temporary internet access to access their messages, read them, or compose new messages or reply to them even if they are not connected to the internet, and then send them when they reconnect to the internet. Examples of this type of email protocol include Yahoo.

The IMAP4 protocol supports users' access to their email messages, whether they are connected to the internet or not, just like POP3 protocol.

Exercise 2

There is more than one fundamental security issues - three problems - in the operation of the IMAP4 protocol. **Could you discuss them and provide practical solutions?**

1

2

3
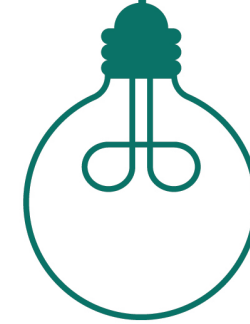
Do you know that...?

To overcome the security concerns of protocol IMAP4, you should use encryption, two-factor authentication, and strong passwords.

Pay Attention!

SMTP is a simple text-based protocol that works well when devices are connected to each other. It is only specific to sending email messages, unlike the protocol of both POP3 and IMAP4, which provide message retrieval from the server. This is why reliance on it has declined.

Instructions:

Read the words below carefully and search the table for consecutive letters that form these words. Below is an example of the word "**protocol**" and how to find its letters in the table:

a	s	v	e	p	r	o	t	o	c	o	l
s	e	t	t	i	n	g	s	p	o	r	t
a	r	c	h	i	v	e	e	r	a	s	e
m	e	s	s	a	g	e	s	b	l	k	s
i	n	b	o	x	w	h	s	e	n	t	y
s	t	o	r	a	g	e	n	m	o	v	e
d	e	v	i	c	e	d	e	l	e	t	e
e	m	a	i	l	b	u	s	e	r	s	a

Protocol - Email - Messages-Users - Device- Settings- Inbox - Sent

Storage - Archive - Delete - Move - Port- Save - Erase

Pay Attention!
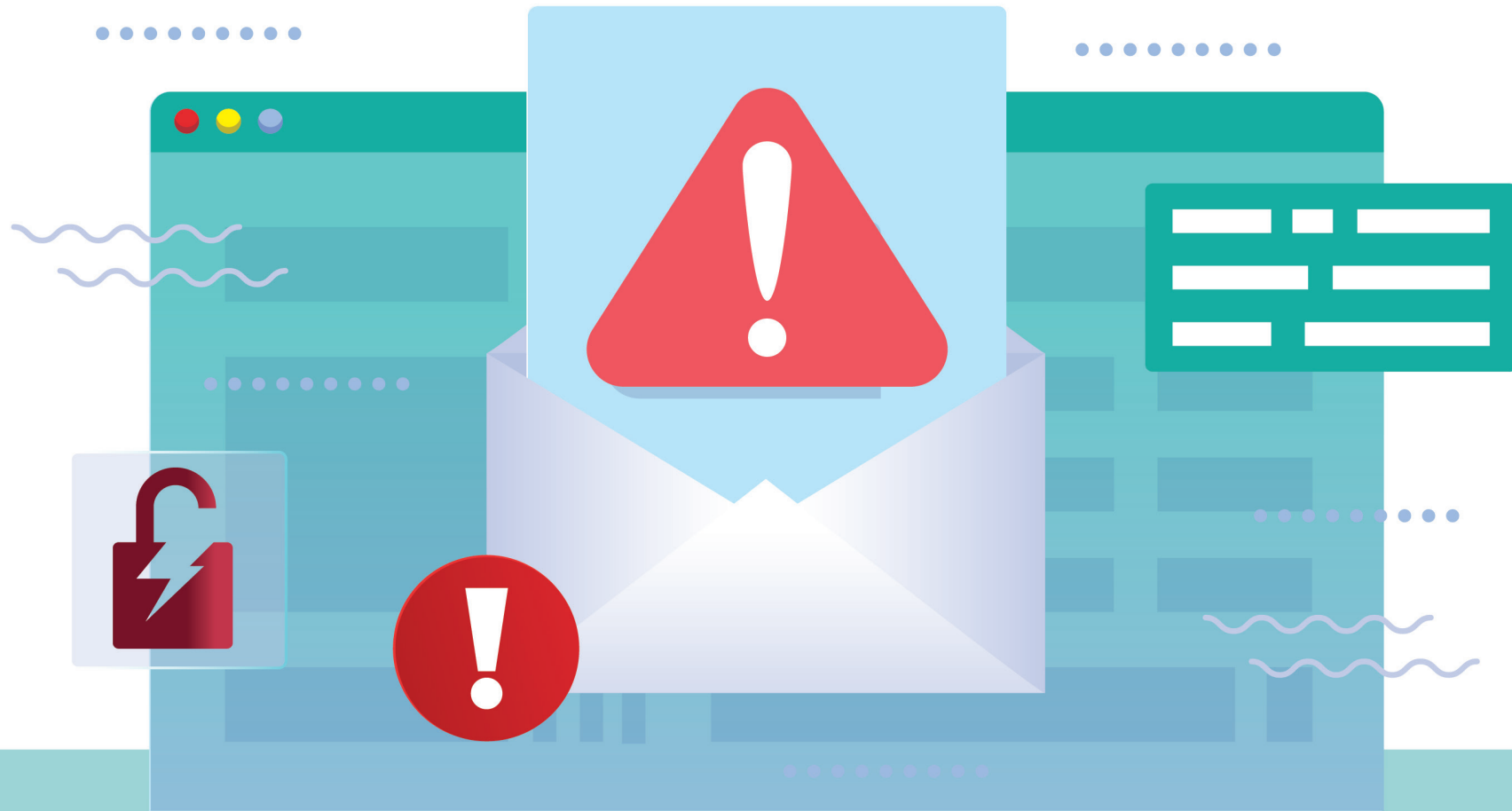
SMTP
One of the drawbacks of SMTP is the lack of email sender authentication, along with the absence of security features, leading to users receiving unwanted messages.

Do you know that...?

Email consists of: sender, recipient, email address, Mailer, mail server, SMTP.
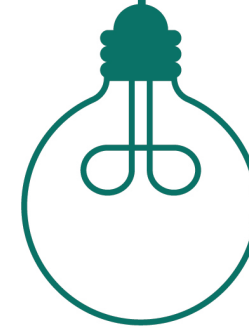
IMAP4 protocol Advantages:

- Access to email messages from multiple devices.

- Quick and efficient access to email messages.

- Multiple users can share a mailbox.

- Organize email messages.

- Supporting email functionalities, such as search and sorting.

- Displaying unread emails in the inbox.
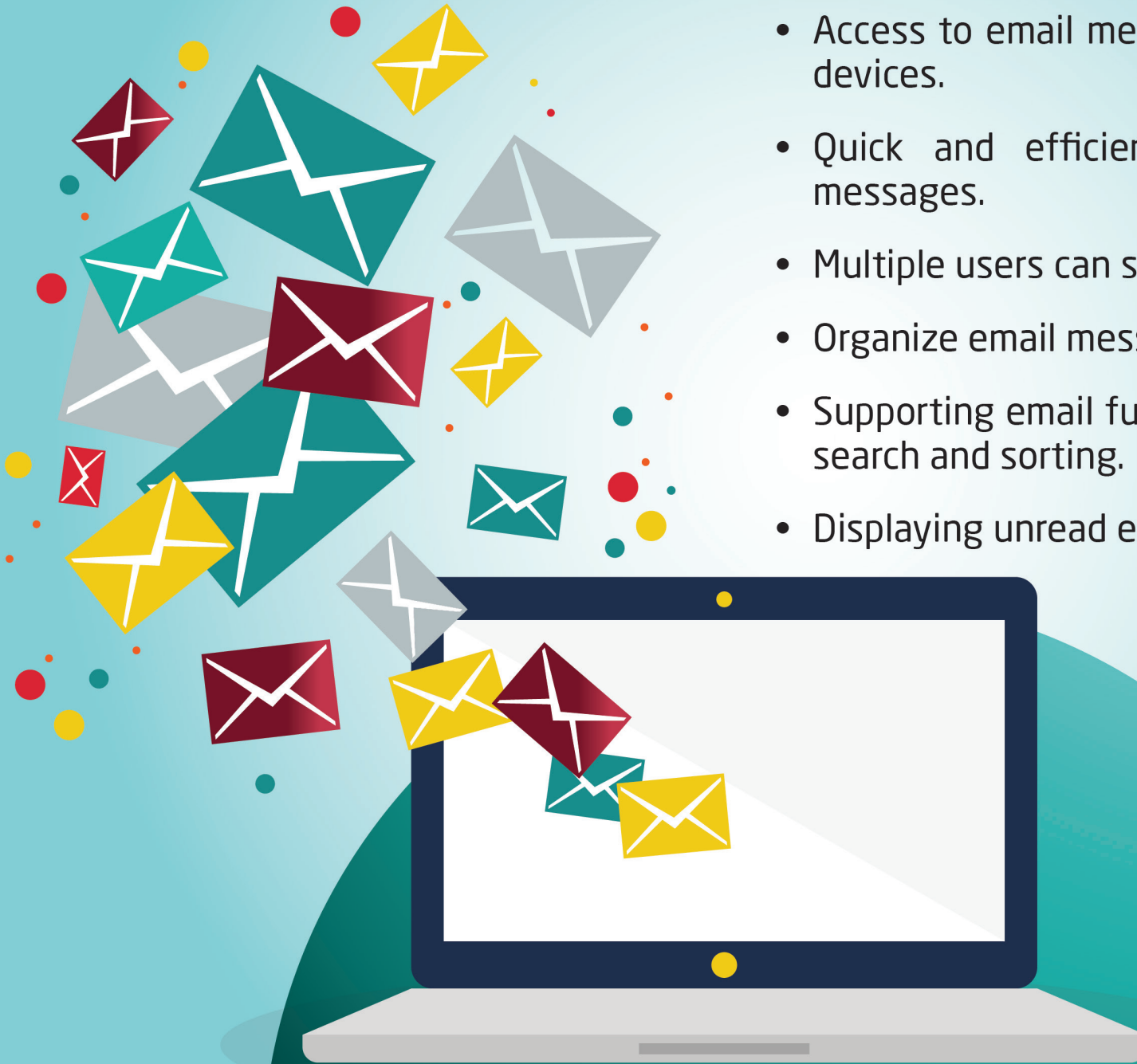
- Ideal for those who need to access their email while traveling or using different devices.

- Directly handling messages on the email server, instead of downloading them to the user's device.

- In IMAP4 protocol, providing email presence on the server ensures higher security in case the user loses or damages their device.

- Eliminating the need to re-download messages when transitioning between devices as they are stored remotely.
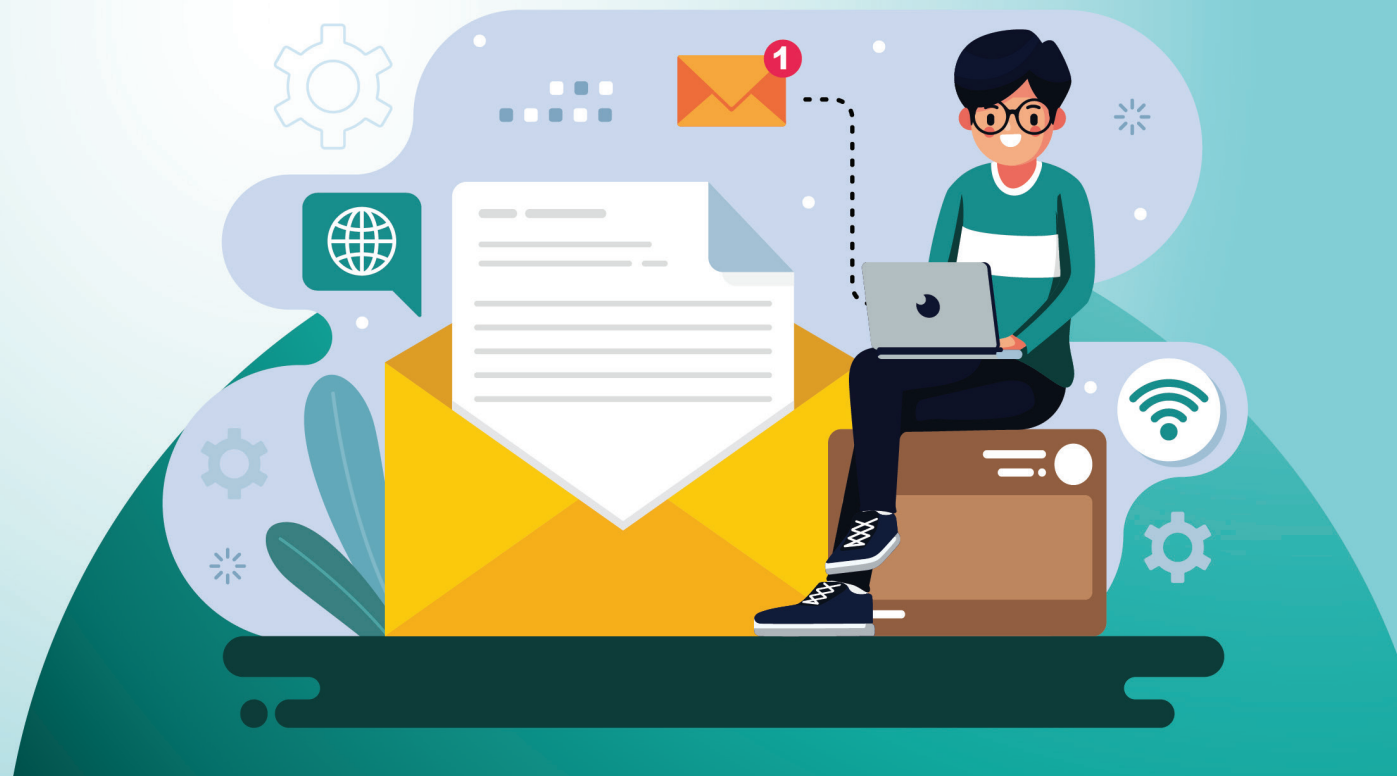
POP3 protocol Disadvantages:

1 Marking messages as read on multiple devices.

2 Incapable of synchronizing sent items.

3 Users must continually set up their device to periodically check their email server to recognize newly received messages.

4 Users need to manually create items like personal folders or adjust settings individually on all devices.

POP3 protocol Advantages:

Ability to store email on devices.

Access to email without an internet connection.

Provides space saving for users by deleting messages after downloading.

Users can leave copies of their email on multiple POP3 servers.

Users can consolidate multiple email accounts into one mailbox.

Data is more secure because no email is stored on a POP3 server.

How IMAP4 works:

1 Connect to the server

2 Authenticate

3 Sync

4 Access messages

5 Process messages

6 Disconnect
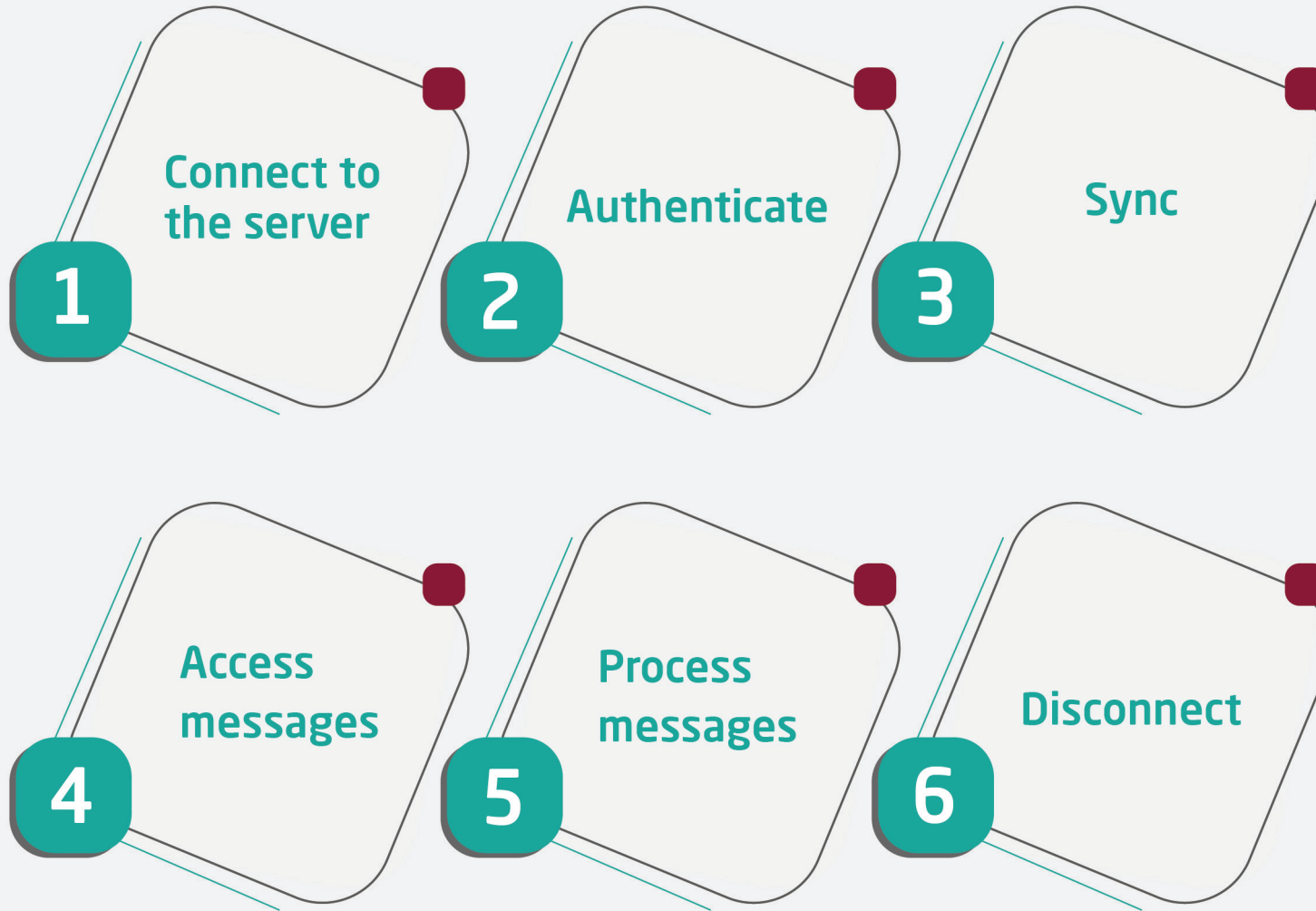
IMAP4 disadvantages:

- Limiting message storage to 200 MB or 500 MB unless you purchase more professional email services.
- Storing all messages on the server increases the chances of E-mail theft and unauthorized access, especially if the user's password is insecure or weak.

Competitions

What is it ?

- A protocol that enables users to organize email messages in folders, mark messages for follow-up, and save message drafts on the server. Users can also display read or unread messages. ....

- It is a communication program between a computer and another to exchange email messages between them. . ...

- Four different email protocols, in terms of features, uses, and importance. ....

- It is a simple and old protocol designed for use on a single computer, supporting only one-way synchronization of email.. ....

- It is a simple text-based protocol that works well when devices are connected to each other, and only specializes in sending email messages. . ...

- A protocol that enables users who use web browsers to access their email messages for sending or receiving, utilized by popular applications like Hotmail and Yahoo. . ...

- It is responsible for sending, receiving, managing, and logging all the data that is done by its own E-mail programs, as well as processing them. ....

Mark (✅) or (❌) in front of the following sentences:

1. The IMAP4 protocol does not store email messages on a remote server away from users. ◯

2. IMAP4 enables users to organize email messages in folders, and mark messages for follow-up. ◯

3. IMAP4 users cannot access email messages from multiple devices. ◯

4. The POP3 protocol is ideal for those who need to access their email messages while traveling or using different devices. ◯

5. There are three similar mail protocols in terms of features, uses, and importance. ◯

6. The POP3 protocol allows email users who have temporary internet access to access their messages, read them, or compose new messages or reply to them when they are not connected to the internet. ◯

7	One of the advantages of protocol POP3 is the ability to store mail on users' personal devices.
8	One of IMAP4's features is time-saving for email users as it allows them to search for email messages on the server.
9	IMAP4 Protocol does not allow logging in via multiple email users on computers or mobile devices and reading the same messages.
10	IMAP4 transmits data, including login information and email content in plain text, which increases the risk of exposing sensitive information to spying or external attacks.
11	The SMTP protocol uses the internet to send and receive messages, and is used by each user's mail program such as Yahoo .

Complete the following phrases

1. Email consists of: ...., ..., ..., Mailer, ..., and SMTP.

2. When the sender uses the mail program, it is redirected to ....which verifies the validity of the recipient's email address.

3. The protocol stores the sent email on the server for later transfer using any of the basic protocols ....

4. In case the recipient has a different domain address (for example, the sender's domain Gmail differs from the recipient's domain Hotmail), protocol .... connects with server ....which communicates with the other address used by the recipient and then SMTP of ....starts connecting with SMTP of .... to deliver the email.

5. In case both ....of the sender and recipient are unable to communicate with each other due to internet problems for example, the mail intended for delivery to the recipient is placed in a queue specific to protocol ....until the problem is solved.

6. In case the recipient uses protocol .... , then the mail he receives is deleted from the web server copy, while in case of using .... , a copy of the email is stored on the web server for interaction at any time desired by the recipient.

7 An example of an online attack using protocol IMAP4 .... that affected users of .... in 2018.

8 To overcome security concerns from protocol IMAP4, one should use ...., and .... strong and different.

9 Protocol .... causes more energy consumption as a result of using more system resources; therefore, it is not the best option for devices ....that contain wireless sensor networks.

10 All HTTP pages are stored within what is known as .... on the internet upon first visit, which makes loading content faster when visiting pages again.

11 There are two types of HTTP messages: ....

12 The user needs an address to access the desired document on the internet, here protocol HTTP uses ....to determine any type of information on the internet, where it defines four parts: ...., and ...., ..., and...............................

Graduation Project

The graduation project is an assignment that you undertake on your own or in collaboration with one or two of your colleagues, under the supervision of the trainer. Through it, you are required to perform one of the following assignments:

Write a short story, essay, or report about a protocol IMAP4

The student takes on the role of a trainer and writes general guidelines to his colleagues or parents explaining the concept and importance of the IMAP4 protocol.

CyberEco

الوكالة الوطنية للأمن السيبراني
National Cyber Security Agency