A-Level
Computer Science

Internet technologies

Lesson Objectives

Students will learn about:

- The Internet and its applications
- Significance of the Internet beyond its use in computers and smartphones
- Dial-up connection
- Broadband connection and its types
- Domain Name System (DNS) in detail

1.

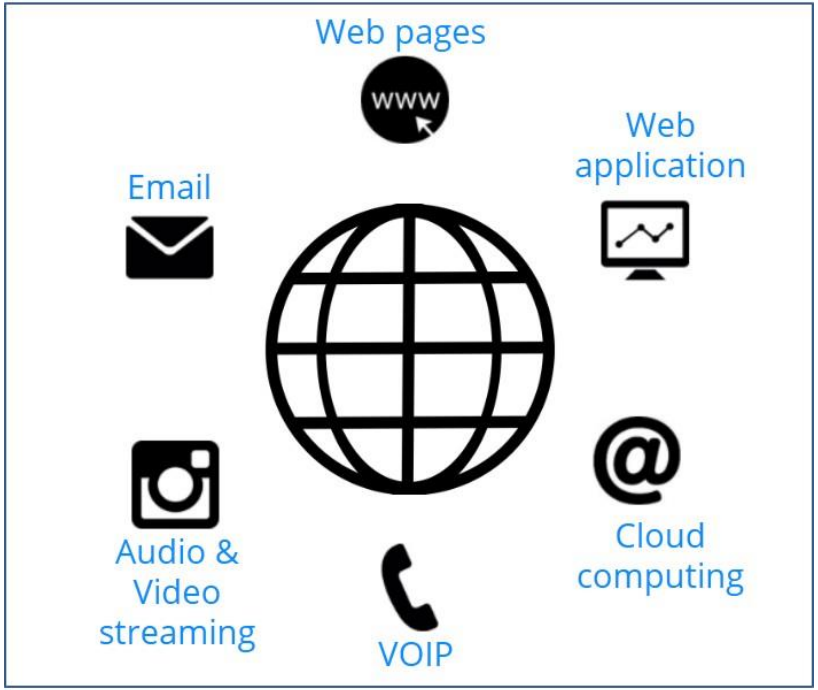
Content

You can’t gaze in the crystal ball and see the future. What the Internet is going to be in the future is what society makes it. It will be what the businesses offer, it will be new products and services. It’s the new ideas that show up that nobody thought of before.

-Robert Elliot Kahn, inventor (along with Vint Cerf) of TCP and IP

Internet

The Internet is a global computer network that provides various technologies and services using standard communication protocols.



Applications of the Internet

- Web pages:
  - HTML pages consisting of text, image and audio files can be accessed using a web browser.
  - For example: Chrome, Firefox, Safari and Internet Explorer
- Web applications:
  - Web software that can be accessed through a browser.
- Applications for smartphones:
  - Various applications that can be accessed through a smartphone without a web browser.

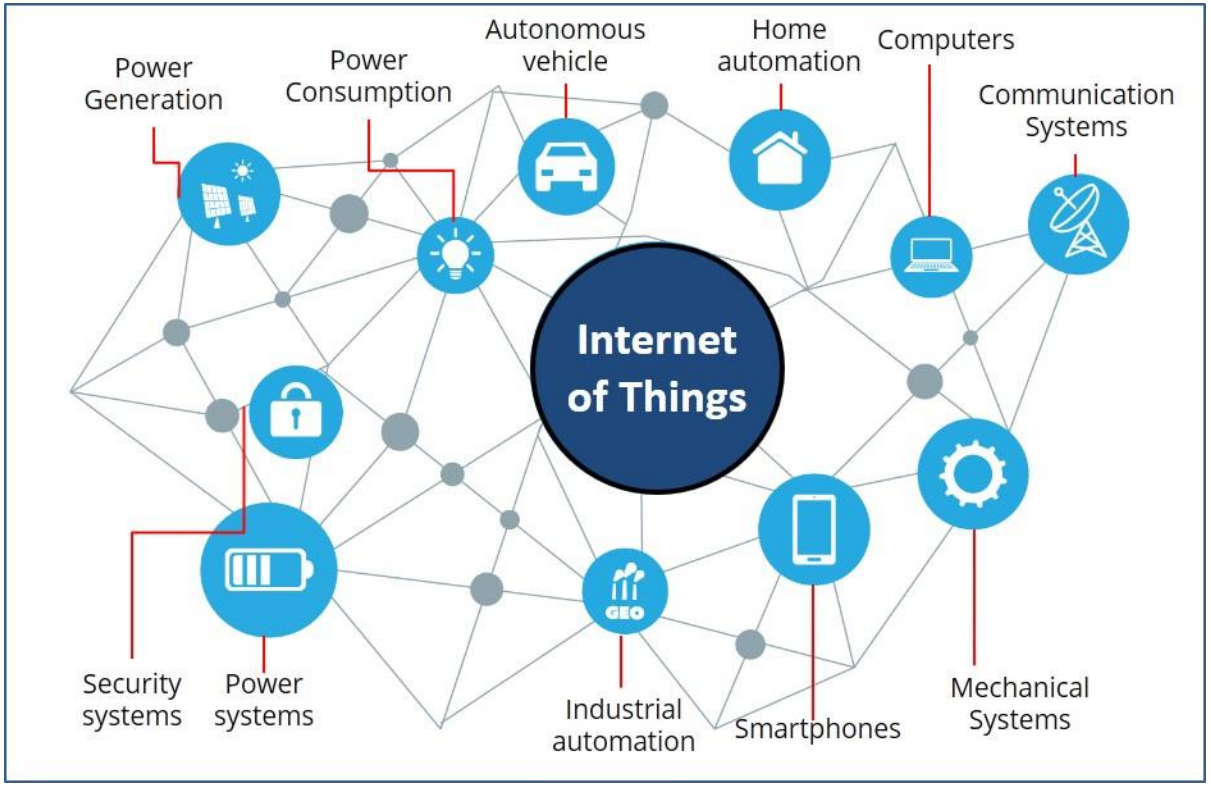
Applications of the Internet

- Cloud computing: Cloud computing enables users to store files remotely.
- VoIP: Voice over Internet protocol enables users to place voice calls over the Internet.
- Audio and video streaming:
  - Various websites and applications allow users to view audio and video files without storing them.
- Email: Email servers allow users to store emails securely and retrieve them when necessary.

Internet of things (IoT)

- IoT is a concept that involves extending Internet connectivity beyond standard devices, such as computers and smartphones.
- The 'thing' in the 'Internet of Things' refers to any range of traditionally Internet-enabled, everyday objects.
- Once the objects are connected to a network, they can exchange real-time data and they can be remotely monitored and controlled.

Internet of things (IoT)

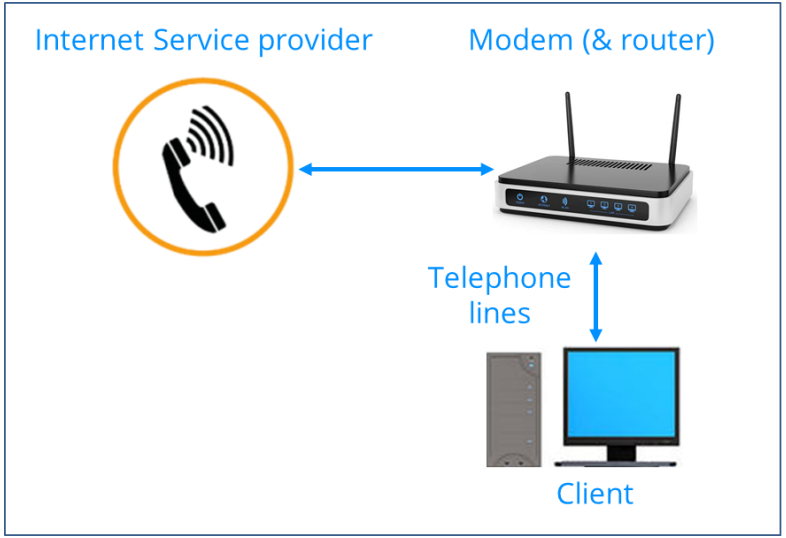


Connecting to the Internet

- A Public Switch Telephone Network (PSTN) connects a computer to an Internet Service Provider (ISP) using a telephone line.
- The user pays for access to the Internet on a per-minute basis.
- A modem is also connected to a computer to convert digital signals to analogue signals and vice versa.
- The data transfer speed of a dial-up connection is 56 kB/s. A user may sometimes experience a low data transfer rate of 20 kB/s in such connections.

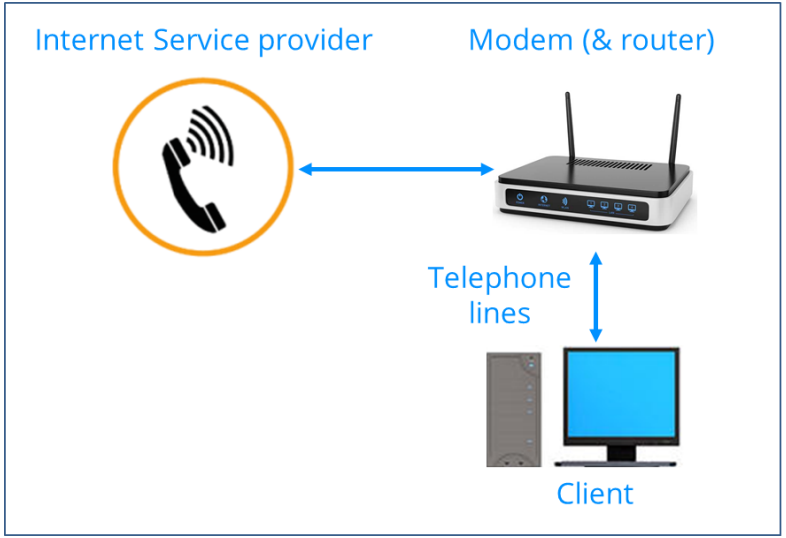
Connecting to the Internet

- A dial-up modem has a limited capacity of connecting only one computer to the Internet at a time.
- In case more than one computer is to be connected, the modem is combined with a router.
- Routers forward data packets along the network and, hence, combine two or more networks.



Connecting to the Internet

- Internet Service Providers connect LAN to the Internet.
- A user selects an ISP based on:
  - the data transfer speed
  - cost
  - download limit
  - type of connection
  - reliability
  - customer service.

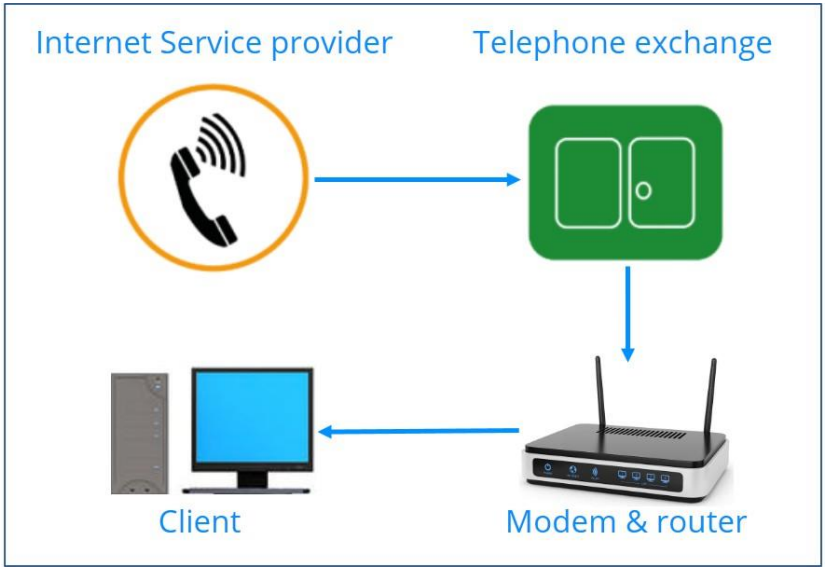


Connecting to the Internet

- Some ISPs also provide email services, hosting service and Wi-Fi hotspots. Hosting services allow us to create and manage websites and store files. The Wi-Fi hotspots can be used when the user is away from home.
- A disadvantage of this type of connection is that voice calls cannot be made while the Internet is being used.

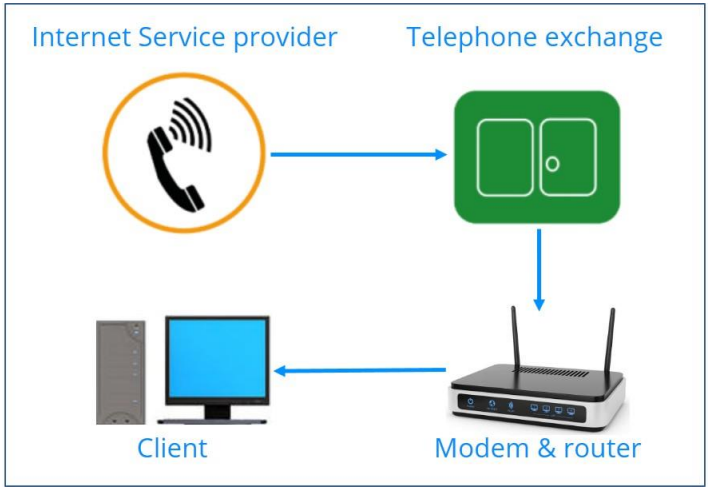
Broadband connection

- High-speed Internet access via wired and wireless networks is called broadband.
- The amount of data that can be transferred from one point to another in a specific time period is called bandwidth.
- More bandwidth is allocated for downloading due to demand. Hence, downloads are faster compared to uploads.



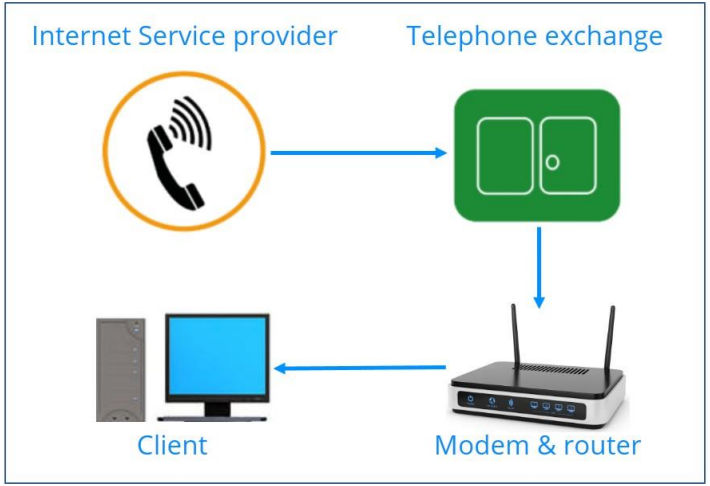
Cable

- A combination of coaxial copper cables and fibre optic cables are used to provide a broadband cable connection.
- Fibre optic cables connect the telephone exchange to various connection points.
- A copper cable connects a house to the nearest connection point.



Asymmetric Digital Subscriber Line (ADSL)

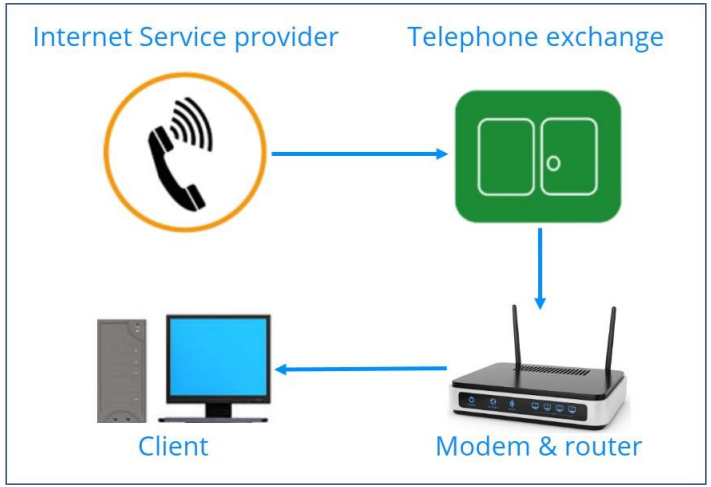
- ADSL is a type of wired broadband connection.
- ADSL uses telephone lines to transmit and receive data, and provides a connection speed of up to 24 Mbps.



Asymmetric Digital Subscriber Line (ADSL)

The download speed reachable by ADSL depends on:

- Distance between the modem and the telephone exchange.
- Phone lines: Speeds may vary between phone lines.
- Internet Service Provider: The modem or router provided by ISP is required to access ADSL.



Domain Name Server (DNS)

- Each computer in a TCP/IP network is uniquely identified by its IP address.
- So, when a user wants to access data from another computer, he/she has to know the IP address of that computer. It is hard to remember the IP address.
- Hence, each IP address hosting a website is mapped to a domain name.
- These domain names are easy to remember and represents a set of web pages.

Domain Name Server (DNS)

- For example: amazon.co.uk is a domain name which stores data related to products and services sold.
- In this domain name, there are various web-pages, such as:
  - ✓ https://www.amazon.co.uk/laptops (a page that leads to laptops available for purchase)
  - ✓ https://www.amazon.co.uk/help (a page that leads to the help menu)

How to view IP address of a domain?

- To view the IP address of a particular domain, a traceroute program can be run on the domain name.
- Along with the IP address of this domain, we would also be able to view the IP addresses of each router passed from our computer.
- A traceroute program can be run by using command prompt. The command for windows is tracert <domain name>.
- Using the command *tracert amazon.co.uk*, the IP address obtained is 54.239.34.171.

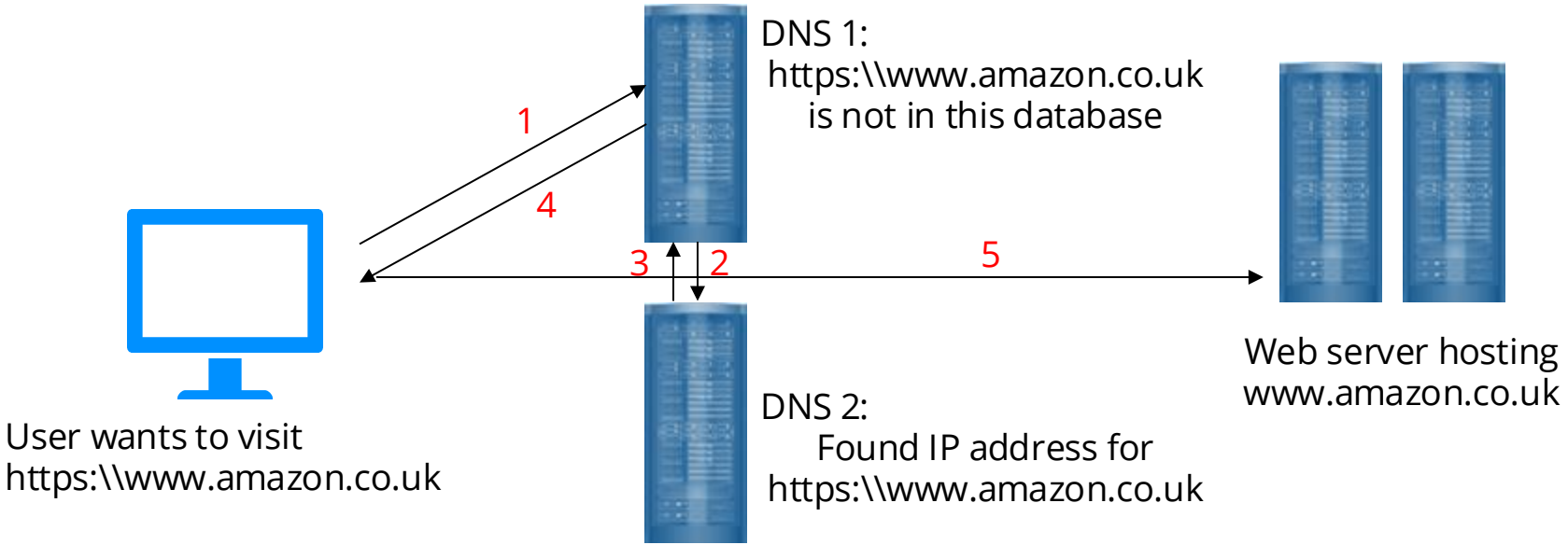
Domain name system

- Each domain name ends with a suffix.
- This suffix represents the top-level domain.
- For example: .gov represents government agencies, .org represents non-profit organisations and .com represents commercial businesses.
- Some domains also have suffixes that represent a country.
- For example: .uk represents domains based in the United Kingdom.

Domain name system: Working

- A user requests the IP address of a domain from a domain name server. The server searches for a match as per the user's request.
- In case, the domain name is not present in a particular server, the request is passed to another server.
- This process continues until all servers have been searched or a match has been found.

Domain name server: Working

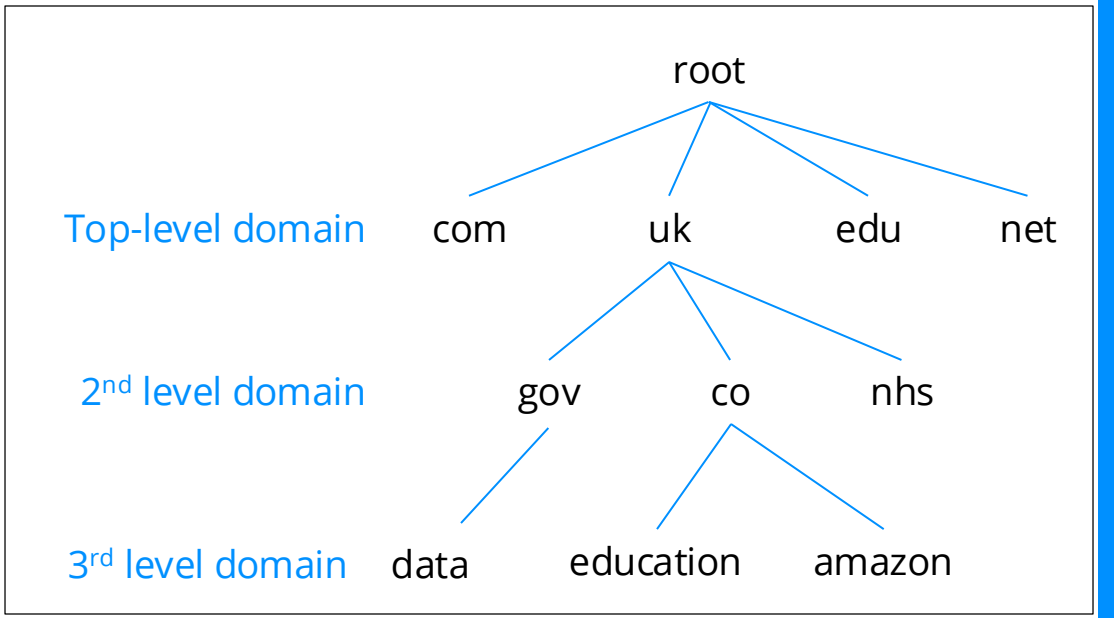


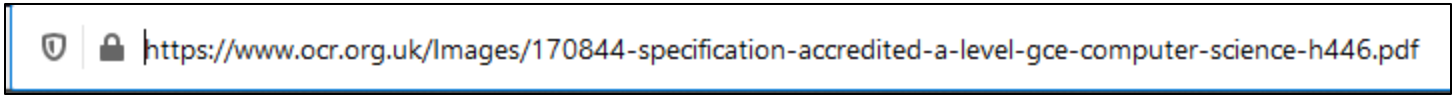
Domain name system

The computer that stores a particular resource is called a host.

The domain name is hierarchical.

The address of a resource is made of several layers of a domain that are separated by a dot.





This URL links to the A-level computer science specification of OCR, which is a pdf file.

Component of URL	Function
https	Name of protocol
www	Host server name
ocr	Domain name
org	2nd level domain
uk	country of top-level domain
Images	Folder structure
170844-specification-accredited-a-level-gce-computer-science-h446.pdf	Name of the resource

Fully qualified domain name

- The website domain name along with the host server name is called a fully qualified domain name.
- www, mail and ftp are some examples of host server names.
- The host server name depends on the resource being requested.

Internet registrars

- The companies that hold the domain names available for purchase are called Internet registrars.
- These registrars are accredited by a governing registry.
- Internet registries are responsible for storing the details of domain names along with the details of company or institution they are assigned to.
- The details range from name of the registrant, date registered, registered mailing address and seller of domain name.
- There are five regional registries in the world which are governed by Internet Corporation for Assigned Names and Numbers (ICANN).
- Each regional registry covers a geographical section.

Cookie

- A message generated by a web server and sent to a web browser; every time user visits a website.
- Collects important information about a user which is then used by a web server to track a user and maintain user preferences.
- Only used to remember user’s habits such as reading, purchases, music, etc. Cookies do not perform any operation. They are only used to store data.
- Personal information such as banking details and passwords are not stored in cookies.
- Information collected in cookies is also subject to data protection and privacy laws.

Let’s review some concepts

Internet

The Internet is a global computer network that provides various technologies and services using standard communication protocols.

Applications of the Internet

Web pages, web applications, applications for smartphones, cloud computing, VoIP, audio and video streaming and email.

Internet of things (IoT)

IoT is a concept that involves extending Internet connectivity beyond standard devices, such as computers and smartphones.

Broadband connection

High-speed Internet access via wired and wireless networks is called broadband.

ADSL

A type of broadband connection that uses telephone lines to transmit and receive data and provides a connection speed of up to 24 Mbps.

Domain Name Server (DNS)

A server that maps domain name requested by a user to its corresponding IP address.

2.

Activities

Activity-1

Duration: 15 minutes

1. A user enters www.onlinegames.co.uk in a web browser. Explain how a DNS server helps in accessing this website.
2. What are the advantages of using a DNS?

Activity-2

Duration: 10 minutes

1. Complete the sentences with the words given. These words can be used one or more times.

domain name	IP address	static	dynamic
octet	Domain name server	database	IPv4

Activity-2

Duration: 10 minutes

A computer in a network is uniquely identified by its _____. An _____ address consists of four _____ numbers. The IP addresses of large websites are _____ and do not change. To permit reuse of IP addresses, personal computers are assigned with _____ IP addresses.

The IP address of a computer hosting a website is mapped to a _____. This provides easy access to the websites. When a user requests access to a website, the _____ is searched in the _____ of _____.

3.

End of topic questions

End of topic questions

1. What is meant by the term Internet?
2. List some applications of the Internet.
3. Explain the Internet of Things concept.
4. Why is download speed always higher than upload speed?
5. How is a broadband connection established between a user and a service provider?

End of topic questions

6. List some top-level domain names with their meaning.
7. What happens if a domain name searched by a user is not present in a particular domain name server?
8. A user visits a webpage with address: https://www.gov.uk/school-term-holiday-dates/lancashire/calendar.pdf

   What details can be understood from this address?
9. What are cookies? What are they used for?