5 The internet and its uses

In this chapter you will learn about:
★ the internet and the World Wide Web
  – the differences between the internet and the World Wide Web
  – what is meant by a uniform resource locator (URL)
  – the purpose and operation of hypertext transfer protocols (HTTP and HTTPS)
  – the purpose and function of a web browser
  – how web pages are located, retrieved and displayed
  – cookies (including session and persistent cookies)
★ digital currency
  – digital currencies and how they are used
  – the process of blockchaining and how it is used to track digital currency transactions
★ cyber security
  – cyber security threats
  – solutions to keep data safe from security threats.

The internet is probably one of the greatest inventions of the twentieth century; it has changed the way the world works and communicates for ever. It is a great source of good, but has also spawned new types of crime which can be just as devastating as physical crime. This chapter will investigate many of the features of the internet but, in particular, will concentrate on cyber security threats, how we can recognise such threats and take the necessary action to stay safe.

5.1 The internet and the World Wide Web (WWW)

5.1.1 The differences between the internet and the World Wide Web (WWW)

The word **internet** comes from INTERconnected NETwork, since it is basically a worldwide collection of interconnected networks. The internet is actually a concept rather than something tangible (that is, something we can touch). It relies on a physical infrastructure that allows networks and individual devices to connect to other networks and devices.

In contrast, the **World Wide Web (WWW)** is only a part of the internet that users can access using web browser software. The World Wide Web consists of a massive collection of web pages, and is based on the hypertext transfer protocol – see Section 5.1.3. Therefore, the World Wide Web is a way of accessing information using the internet; so the internet and the World Wide Web are actually quite different. In summary:

▼ **Table 5.1** Summary of differences between the internet and the World Wide Web

Internet *hardware*	World Wide Web (WWW) *software*
• users can send and receive emails	• it is a collection of multimedia web pages and other information on websites
• allows online chatting (via text, audio and video)	• http(s) protocols are written using hypertext mark-up language (HTML)
• makes use of transmission protocols (TCP) and internet protocols (IP)	• uniform resource locators (URLs) are used to specify the location of web pages
• it is a worldwide collection of interconnected networks and devices	• web resources are accessed by web browsers
	• uses the internet to access information from web servers

5.1.2 Uniform resource locators (URLs)

Web browsers are software that allow users to access and display web pages on their device screens. Browsers interpret **hypertext mark-up language (HTML)** sent from websites and produce the results on the user's device. **Uniform resource locators (URLs)** are text addresses used to access websites. A URL is typed into a browser address bar using the following format:

> Web browsers are usually just referred to as browsers

protocol://website address/path/file name

The protocol is usually either http or https.

The website address is:

» domain host (www),
» domain name (website name),
» domain type (.com, .org, .net, .gov, for example),
» and sometimes country code (.uk, .de, .cy, for example).

The path is the web page, but is often omitted and it then becomes the root directory of the website (see example below).

The file name is the item on the web page. For example:

https://www.hoddereducation.co.uk/ict

5.1.3 HTTP and HTTPS

Hypertext transfer protocol (http) is a set of rules that must be obeyed when transferring files across the internet. When some form of security (for example, SSL or TLS) is used, then this changes to https (you will often see the green padlock 🔒 in the status bar as well). The 's' stands for secure, and indicates a more secure way of sending and receiving data across a network (for example, the internet).

5.1.4 Web browsers

As mentioned earlier, browsers are software that allow a user to access and display web pages on their device screens. Browsers interpret (translate) the HTML from websites and show the result of the translation; for example, videos, images/text and audio. Most browsers have the following features:
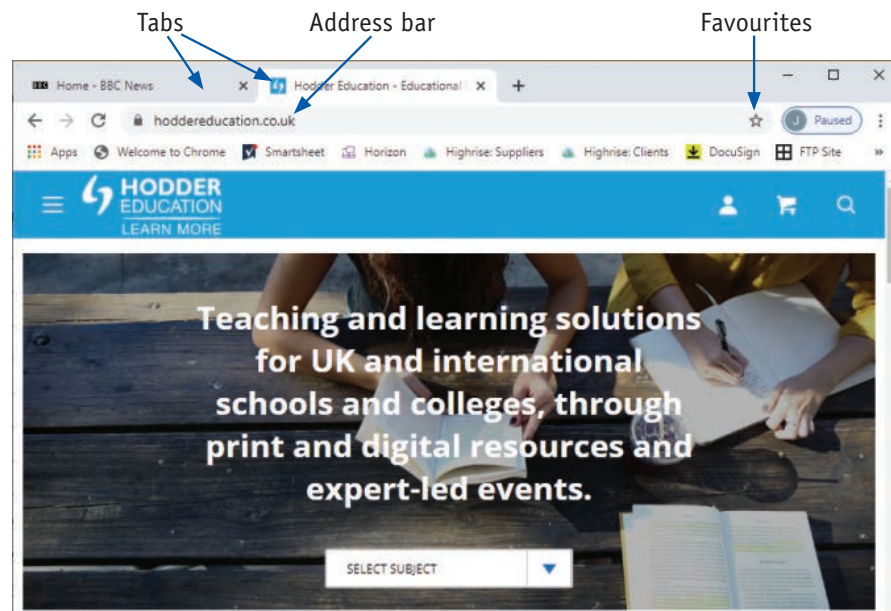
» they have a home page
» they can store a user's favourite websites/web pages (referred to as bookmarks)
» they keep a history of websites visited by the user (user history)
» they have the ability to allow the user to navigate forwards and backwards through websites/web pages already opened
» many web pages can be open at the same time by using multiple tabs
» they make use of cookies (see Section 5.1.6)
» they make use of hyperlinks that allow navigation between websites and web pages; links can be opened in one of two ways:

either open in a new tab by using <ctrl> + <click>

or open in the same tab by simply clicking on the link

www.hoddereducation.com

▲ **Figure 5.1**

» data is stored as a cache (see Section 5.1.5)
» make use of JavaScript
» they use an address bar; for example:

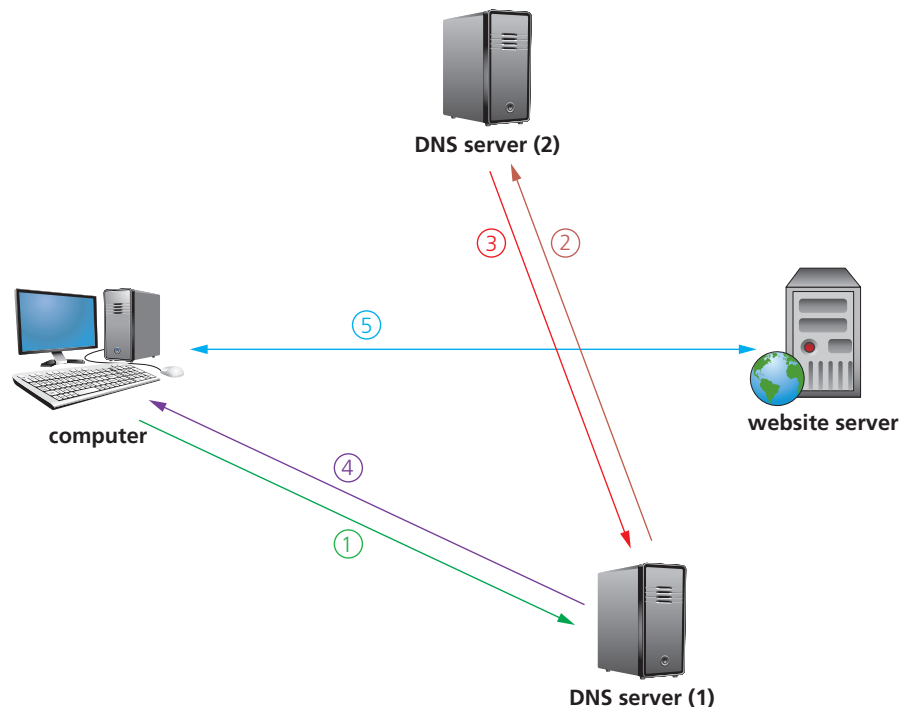
▲ **Figure 5.2** Browser address bar

5.1.5 Retrieval and location of web pages

HTML (HyperText Markup Language) is a language used to display content on browsers. All websites are written in HTML and hosted on a web server that has its own IP address. To retrieve pages from a website your browser needs to know this IP address. The **Domain Name Server (DNS)** (also known as domain name system) is a system for finding IP addresses for a domain name given in a URL. URLs and domain name servers eliminate the need for a user to memorise IP addresses. The DNS process involves converting a URL (such as www.hoddereducation.co.uk) into an IP address the computer can understand (such as 107.162.140.19). The DNS process involves more than one server.

DNS servers contain a database of URLs with the matching IP addresses. Figure 5.3 shows how a web page can be located and then sent back to the user's computer. The DNS plays a vital role in this process:

Link

For more on IP addresses see Section 3.4.

▲ **Figure 5.3** How DNS is used to locate and retrieve a web page

(1) The user opens their browser and types in the URL (www.hoddereducation.co.uk) and the browser asks the DNS server (1) for the IP address of the website.
(2) In this case, let's assume the DNS server can't find www.hoddereducation.co.uk in its database or its cache, so it sends out a request to a DNS server (2).
(3) The DNS server (2) finds the URL and can map it to 107.162.140.19; this IP address is sent back to the DNS server (1) which now puts this IP address and associated URL into its cache/database.
(4) This IP address is then sent back to the user's computer.
(5) The computer now sets up a communication with the website server and the required pages are downloaded. HTML files are sent from the website server to the computer. The browser interprets the HTML, which is used to structure content, and then displays the information on the user's computer.

(Note: in this case, the IP address was found on the second DNS server.)

5.1.6 Cookies

Cookies are small files or code stored on a user's computer. They are sent by a web server to a browser on a user's computer. Each cookie is effectively a small look-up table containing pairs of (key, data) values, for example, (surname, Jones) (music, rock). Every time a user visits a website, it checks if it has set cookies on their browser before. If so, the browser reads the cookie which holds key information on the user's preferences such as language, currency and previous browsing activity. Cookies allow user tracking and maintain user preferences. Collected data can also be used to customise the web page for each individual user. For example, if a user buys a book online, the cookies remember the type of book chosen by the user and the web page will then show a message such as *"Customers who bought Hodder IGCSE ICT also bought Hodder IGCSE Computer Science"*.

There are two types of cookie:

» session cookie
» persistent (or permanent) cookie.

If a cookie doesn't have an expiry date associated with it, it is always considered to be a session cookie. So what are the basic differences?

Session cookies

Session cookies are used, for example, when making online purchases. They keep a user's items in a **virtual shopping basket**. This type of cookie is stored in temporary memory on the computer, doesn't actually collect any information from the user's computer and doesn't personally identify a user. Hence, session cookies cease to exist on a user's computer once the browser is closed or the website session is terminated.
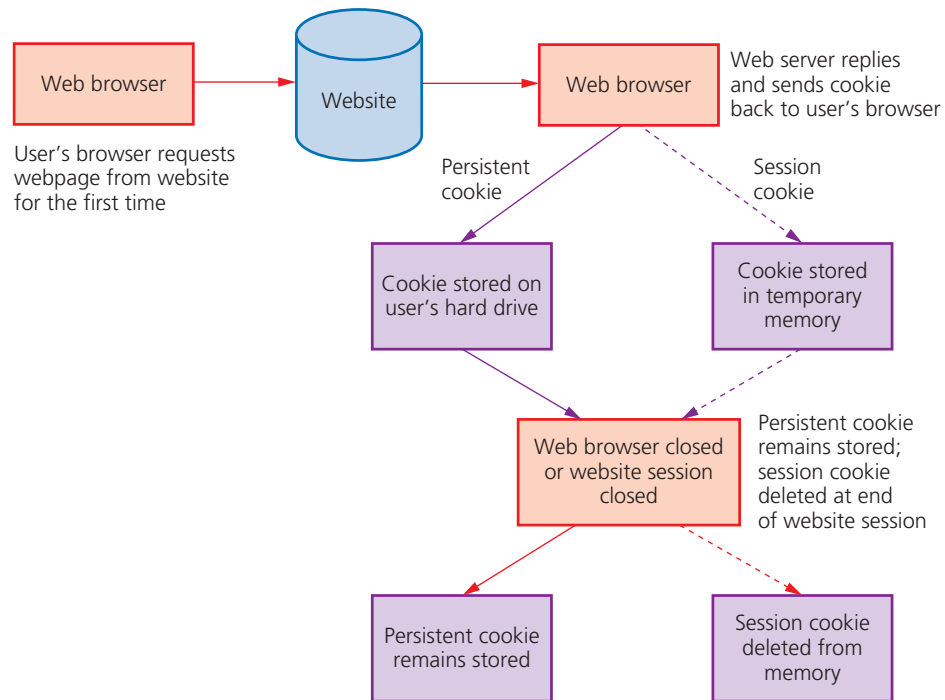
Persistent (permanent) cookies

Persistent cookies remember a user's log in details (so that they can authenticate the user's browser). They are stored on the hard drive of a user's computer until the expiry date is reached or the user deletes it. These cookies remain in operation on the user's computer even after the browser is closed or the website session is terminated. Their advantage is that they remove the need to type in login details every time a certain website is visited. Some websites use cookies to store more personal information or user preferences. However, this can only be done if the user has provided the website with certain personal information and agrees to it being stored. Legitimate websites will always encrypt any personal information stored in the cookie to prevent unauthorised use by a third party that has access to your cookie folder. Many countries have introduced laws to protect users and these cookies are supposed to become deactivated after six months (even if the expiry date has not yet been reached).

Persistent cookies are a very efficient way of carrying data from one website session to another, or even between sessions on related websites; they remove the need to store massive amounts of data on the web server itself. Storing the data on the web server without using cookies would also make it very difficult to retrieve a user's data without requiring the user to log in every time they visit the website.
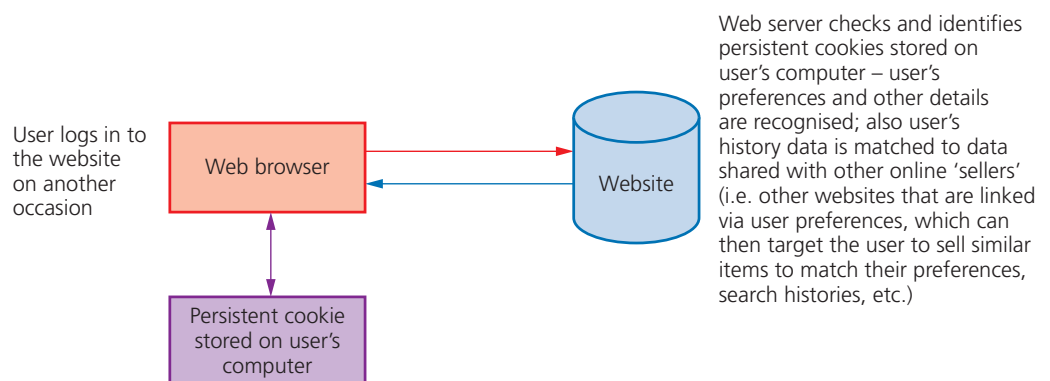
this tracks data about users, such as IP addresses and browsing activity

Figures 5.4 and 5.5 summarise what happens when a website is first visited and then what happens in subsequent visits:

1 First time the user logs in to website:

▲ **Figure 5.4** Cookies (first login)

2 User logs in to website again

▲ **Figure 5.5** Cookies (subsequent logins)

Summary of the uses of (persistent) cookies:

» allow the website to remember users' passwords, email addresses and invoice details, so they won't have to insert all of this information every time they visit or every time they purchase something from that website
» serve as a memory, enabling the website to recognise users every time they visit it
» save users' items in a virtual shopping basket/cart
» track internet habits and users' website histories or favourites/bookmarks
» target users with advertising that matches their previous buying or surfing habits
» store users' preferences (for example, recognise customised web pages)

» are used in online financial transactions
» allow progress in online games and quizzes to be stored
» allow social networking sites to recognise certain preferences and browsing histories
» allow different languages to be used on the web pages automatically as soon as users log on.

Activity 5.1

1   A URL being entered is: **http://www.urlexample.co.ie/sample_page**

Identify:

a   the domain name
b   the domain type
c   the file name
d   which protocol is being used.

2   a   Give two differences between session cookies and persistent cookies.

b   Describe three uses of cookies.

3   The following table shows five features of the internet and the World Wide Web. Tick (✓) the appropriate box to indicate which feature refers to the internet and which feature refers to the World Wide Web:

Feature	Internet	World Wide Web
it is possible to send and receive emails		
makes use of http protocols		
uses URLs to specify the locations of websites and web pages		
resources can be accessed by using web browsers		
makes use of TCP and IP		

4   Why do you think persistent cookies are sometimes referred to as *tracking cookies*? Give at least two pieces of evidence to support your answer.

5.2 Digital currency

5.2.1 What is digital currency?

Digital currency exists purely in a digital format. It has no physical form unlike conventional **fiat currency** (for example, $, £, €, and ¥).

(Note: Fiat is a Latin word meaning 'let it be done'; since conventional currency is backed by governments and banks rather than being linked to gold or silver reserves, it is referred to as fiat currency.)

Digital currency is an accepted form of payment to pay for goods or services. As with cash or credit/debit cards, digital currency can be transferred between various accounts when carrying out transactions. It has made it possible to bank online (for example, using *PayPal*) or via a smartphone app (for example,