INTRODUCTION

About this pack

This unit introduces candidates to computer networking at Intermediate 2 level and aims to develop knowledge and skills in a range of areas as outlined in the content grid for this unit.

The learning and teaching material is split into four sections:

1. **Network applications** – three of the services provided by the Internet (WWW, electronic mail and file transfer); e-commerce, converging technology and implications.
2. **Network security** – security measures, threats to security, need for backup.
3. **Data transmission** – types of transmission, connection to the Internet, additional hardware.
4. **Network protocols** – the domain name system.

Each section includes:

- a statement of the main area covered in the section
- reading material covering the knowledge required for the unit
- investigative and research tasks which direct candidates to use magazines and appropriate web sites to find out specific information on particular areas
- self assessment questions which can be used by candidates as they read through the notes
- practical activities which should help to consolidate the learning and ensure that candidates have opportunities to demonstrate the practical skills needed to pass the unit
- key points at the end of the section that aim to sum up the required knowledge for the candidate, and
- revision questions which could be set as homework or used as preparation for unit or course assessment.

Supplementary to this pack is a PowerPoint presentation covering the main points as contained in the content grid for the unit. This may be downloaded from NQ Online.

The order follows that outlined in the content grid in the unit specification. This order may not be the most appropriate for every

situation and tutors may feel that the treatment would be better in another form.

Practical tasks which allow candidates to demonstrate skills required for Outcome 2 have been indicated.

The questions included in the pack may be seen as a way of assessing students' progress in a summative way but it should be noted that these questions may be used for small group discussion or other more formative approaches to assessment.

Note: candidates undertaking this unit as part of the Intermediate 2 Computing course should be given opportunities to develop problem solving skills in the context of extended response questions. Examples of these are given in the Revision Questions at the end of each section. Examination questions may also require the candidate to integrate knowledge and understanding from the other units in the course.

Resources required for this unit

General

This unit aims to develop knowledge and skills in the area of computer networks and it is assumed that candidates will have regular access to a computer network and to the Internet.

Internet access ought to include the World Wide Web, electronic mail and file transfer. Many web browser applications will include the capability to allow access to electronic mail and file transfer. This is a perfectly acceptable approach in the context of this unit.

Section 1

Internet access is required to allow candidates to explore the use of the World Wide Web, electronic mail and file transfer. A web browser can be used to access WWW, e-mail and file transfer as the importance of this application to achieve more than one task is highlighted within the pack.

The Orange 'Future Home' video (freely available from http://www.orange.co.uk/about/community/future_home_downloads.html) is a good resource for the topic 'converging technology'.

It would be useful to have copies of the school/college code of conduct for Internet use to allow candidates to discuss the issues contained in it.

Section 2

A data encryption program such as PGP would be useful to demonstrate the use of data encryption. Recent copies of news articles about the debate over data encryption would be helpful in the discussion of the use of encryption.

Copies of the centre's acceptable use agreement for Internet access would allow discussion of its contents in the context of filtering.

Section 3

Section 3 covers the more theoretical aspects of data transmission and has no requirements over those generally required for the unit.

Section 4

This short section looks at network protocols and in particular focuses on domain name resolution. In order to provide some practical activity in this section a task asks the student to enter IP addresses directly into the web browser. To prepare for this it would be helpful to have a list of IP addresses which lead to something reasonably interesting. One has been provided in the pack but these should be complemented. If there is a school Intranet it might be included in the list.

Learning and teaching approaches

These materials concentrate on what the student should know and understand. They can be used in a variety of different ways but it should be noted that they are not designed as an open learning resource. It is the intention that these materials should support learning in conjunction with appropriate direct teaching and support by the tutor.

SECTION 1

Network applications

In this section you will learn about the following network services:

1. World Wide Web
2. Electronic mail
3. File transfer

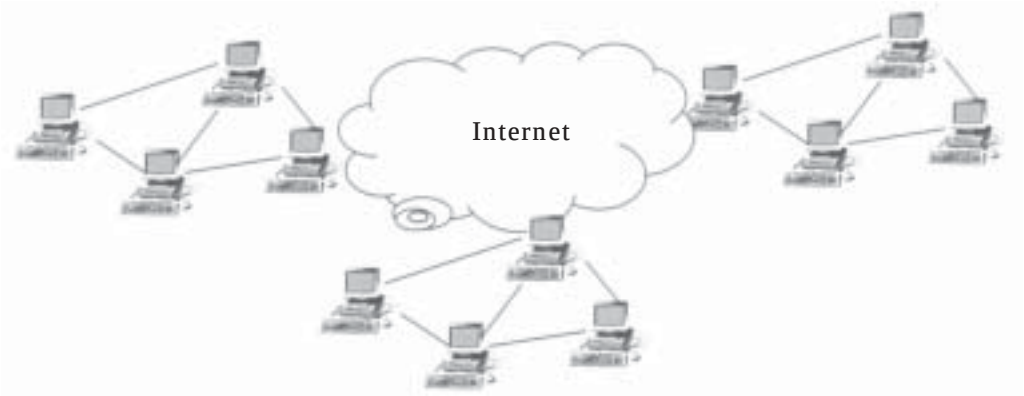
You will also learn about the economic and legal implications of the use of these services and about e-commerce and converging technologies.

Introduction

In recent times more and more computers have become part of a computer network. A computer network consists of two or more computers connected together so that hardware devices such as printers can be used by more than one person and also so that data can be shared.

Networks are usually referred to as **Local Area Networks** (LANs) **or Wide Area Networks** (WANs). A LAN is usually set up in a single building or office. The computers are linked together to allow hardware such as printers to be shared by a number of users as well as the sharing of data and internal communications. WANs, on the other hand, tend to be spread out over far larger areas and use the public telephone network to allow the connection to be made. Although WANs can be owned by a single organisation, many are available to large numbers of users.

Networks have become more and more interlinked which has resulted in the development of the Internet. The Internet could be described as a WAN but is more accurately thought of as a network of networks due to the fact that LANs and WANs run by individual organisations are joined together to make up the Internet.



The Internet allows users to share information and to communicate with others across the world in a very short time. This has huge economic and legal implications which will be discussed later in this section.

The Internet provides users with a number of services. In this unit we will look in detail at three of these:

- World Wide Web
- Electronic mail
- File transfer

Accessing the Internet

Before gaining access to the Internet appropriate **hardware**, **software** and an **Internet Service Provider** (ISP) are required.

Hardware

As well as a computer, extra hardware will be required to allow the connection to be made with the Internet. This may be in the form of a **modem** or **cable modem** when connecting a computer at home to the telephone network or cable television network or a **network interface card** if the computer is part of a LAN in an office. This hardware will be discussed in more detail in Section 3.

Software

Communication software is required to allow the computer access to the appropriate Internet service. The most widely used item of communication software is the web browser. This allows the user to download web pages but may also provide access to electronic mail and to file transfer facilities. Examples of web browsers include Microsoft Internet Explorer and Netscape Navigator.

More features are available if dedicated software for electronic mail and file transfer is used.

Internet service provider

An ISP is a company which allows an individual user to connect to the Internet. Users are said to subscribe to an ISP. The ISP ensures that the subscribers have the correct software to allow a connection to be made and also to provide services such as electronic mail addresses and web space to allow the subscriber to set up their own web pages. Examples of ISPs include BT Internet, AOL and many more.

The individual subscriber will either use a modem connected to a conventional telephone line or a cable modem to provide broadband access. These will be discussed in more detail in Section 3.

In order to save money and have greater control over access to the Internet many larger organisations such as schools, colleges and businesses will set up their own ISP. Users within the organisation will access the Internet from within a Local Area Network. The organisation will provide an e-mail address to each user and will provide security features to reduce the risk of inappropriate use.

Investigation

In this task you are going to look at what is offered by three ISPs. Work with two or three other people to research this task. Share out tasks and write up a report individually once you have gathered all the information you require.

In your report you should try to answer these questions:

- What facilities and services does each ISP offer to subscribers?
- What costs are involved in subscribing to the ISP?
- What issues should you consider when deciding which ISP to choose?

You should also find out how you gain access to the Internet in your school or college and include details of the services provided.

Self assessment questions

1. What is a **computer network**?
2. What is the difference between a **LAN** and a **WAN**?
3. What is required to gain access to the Internet?
4. What is the purpose of an **Internet Service Provider**?
5. Why might a larger organisation choose to set up its own ISP?

Internet services

Let us now look in detail at three of the services provided by the Internet

The World Wide Web

Millions of people use the Internet every day for work, research and entertainment.

One of the main services provided by the Internet is the **World Wide Web** (WWW). This is a huge source of information on every subject imaginable. The WWW is not a single source of information like a huge encyclopaedia, rather there are computers all around the world which are used to store web pages. Each of these computers is known as a server.

The information is split into millions of individual pages of information known as **web pages**. The pages are grouped together and organised by people or organisations according to their interests or business. These groups of pages are known as **web sites**. There is usually a main page called the **home page** which provides links to the other pages of the web site. Web pages are made up of text, pictures, sounds and video and are formatted using a language called **HTML** which stands for **Hypertext Markup Language**.

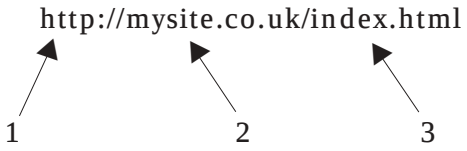
The web browser

To access web pages a **web browser** is used. This is software which requests the appropriate page and then decodes the information stored in the file once it has been downloaded so that the page can be viewed properly.

The universal resource locator

Every web page has its own **universal resource locator (URL)** to identify it. This describes where the web page is stored, the format it is in and how it can be downloaded.

The URL is made up of a number of parts. Here is an example:



The URL is made up of three main components:

1. The first component is the protocol. **http** stands for **Hypertext Transfer Protocol**. This is the method used to transfer the web page from the server to the user's computer. All web pages use http but you may also use ftp which is short for file transfer protocol.

2. The next component identifies the particular **server** where the web page is stored. This is the computer system which hosts the web pages. Every server has its own unique address which is used

to identify it. Usually the server name is related to the organisation which owns it.

There are a large number of possible combinations for the suffixes to the server name. Each of these provides us with some information about the organisation.

This table gives some examples.

Suffix	**Meaning**
.com	a commercial company
.net	a network organisation
.org	an organisation such as a charity (usually non profit making)
.gov	a governmental organisation such as the Scottish Executive or parliament
.sch	a school
.ac	a university or college of further or higher education
.mil	military

Note that these suffixes have to be interpreted carefully – for example an individual may register a .com host.

The World Wide Web was first developed in the United States of America and the idea of a country as part of the domain name only came about after the initial development. A country code is often added to allow identification of the source of the web page. The following table gives some examples.

Suffix	**Country**
.uk	United Kingdom
.nl	The Netherlands
.de	Germany
.fr	France

3. The last component of the URL is the pathname of the web page. This is the filename on the server. Each '/' symbol in the pathname indicates a folder on the server. The end of the filename states that it is formatted using html.

   Some pathnames include special characters which are interpreted by the server. If a URL is entered to download a web page then every character must be correct.

Features of a web browser

The web browser allows the user to download web pages and to navigate between sites and individual files. In the next section we will use some of these features in order to find out more about using the World Wide Web.

Extra features of a web browser

The functions of a web browser include more than just being able to access web pages. Most modern browsers also allow the user to carry out file transfer and to access electronic mail services. These applications are discussed in detail in the next section.

Self assessment questions

6. What is the **World Wide Web**?

7. What software is required to access the World Wide Web?

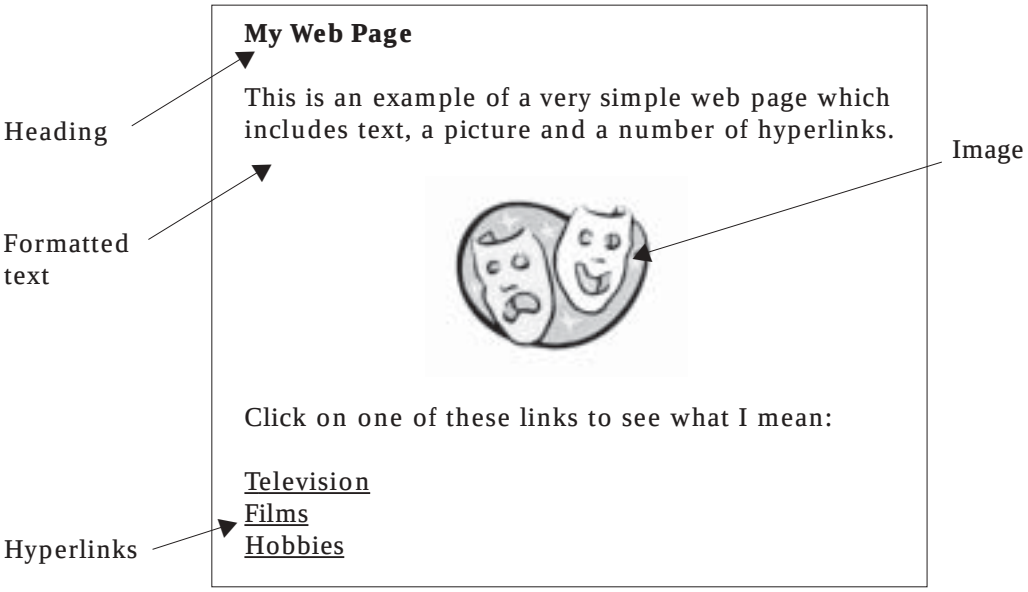
8. What is the purpose of a Universal Resource Locator?

9. Describe the main components of a URL.

10. What is a **home page**?

What is a web page?

A web page can contain many different types of data including text, graphics, video, audio and hyperlinks. A **hyperlink** is a piece of text which will load another web page when the user clicks the mouse button on it.



A server will store many web pages but each is made up of a simple text file of HTML code. HTML provides information for the browser about the layout of the page, where pictures should appear, the font and style of the text as well as the text that will be highlighted as hyperlinks.

Here is an example of the HTML for the web page shown above.

```
<HTML>
<H1>My Web Page </H1>
<P>
This is an example of a very simple web page which includes text, a picture
and a number of hyperlinks.
<P>
<center>
<img source = 'faces.gif'>
</center>
<a href='http://www.television.com'>Television </a>
<a href='http://www.films.com'>Films </a>
<a href='http://www.hobbies.com'>Hobbies </a>
</BODY>
</HTML>
```

Practical task (can be used as evidence for Outcome 2)

Try to create a simple web page using the tags shown in the example above. If you want to be more adventurous your tutor may be able to give you more detailed information about html.

You must save the file with the .htm suffix.

Mobile access to the Internet

We live in a fast-changing society where technological innovation is continually altering the way we communicate. One of the biggest changes in recent years has been the introduction of the mobile phone. Most of us now use a mobile phone frequently and would be lost without it.

Development of mobile phones has led more recently to the ability to use them to gain access to the Internet. This is done using a special protocol known as **WAP** which stands for **Wireless Application Protocol**.

A microbrowser is stored in the mobile phone to allow specially enabled web pages to be viewed on the small viewing area available on a mobile phone screen. This software requires very little hardware resources and does not require a powerful processor. The pages downloaded for WAP use a restricted version of HTML known as **WML** (**Wireless Markup Language**).

The mobile phone accesses the Internet through the operator's network and then via a WAP gateway. This gateway is the interface between the operator's network and the Internet.

Investigation

Use appropriate magazines or web sites to find out the currently available hardware required to access WAP services. Also try to find out about the availability of web sites which have been modified for WAP use.

Create a short presentation of your findings to share with your group.

Self assessment questions

11. What does **WAP** stand for?

12. What sort of device would use **WAP**?

13. What is a **microbrowser** and how is it different from a conventional browser?

14. What language is used for web pages which have been specifically formatted for microbrowsers?

Practical task using the World Wide Web

You will need access to the World Wide Web using web browser software on your computer. You are going to navigate through the WWW using five different techniques. Once you have finished each task you should write a short report describing the technique used. You should also note the URL of each page you download.

1. **Following hyperlinks**

   - Open your web browser.

   - When your home page has loaded, look for some hyperlinks on the page. Hyperlink words are usually in a different colour from the rest of the text on the page and are usually underlined.

     This is a hyperlink

     It is also possible that a hyperlink may be a picture. Many web sites are designed to be interesting to look at and so use graphics to help to enliven the presentation. If you move the pointer over a picture it may change into a small hand symbol like this:

     This signifies a hyperlink. When you click the mouse button once over a hyperlink the web browser will look for the URL of the web page requested and will then download the page.

- Try experimenting by looking for information by clicking on appropriate hyperlinks.

Note:
If you get lost you should be able to click on the **home** button on your web browser's toolbar to return you to the home page.

2. **Using navigation buttons**

- Most web browser software provides navigation buttons which allow the user to move backwards and forwards between the pages you have downloaded recently.

- Try moving backwards and forwards through the web pages you downloaded in part 1 of this exercise.

3. **Using the universal resource locator**

- As already mentioned, every web page has its own unique URL. One of the fastest ways of gaining access to a web page is to enter the URL of the page in the address box of the browser.

address | http://www.christmas.com

- Try entering the URL of a number of web sites with which you are familiar. Here are a few examples to get you started:

www.bbc.co.uk
www.nasa.gov
www.yahoo.com

4. **Bookmarks/favourites**

- When you find a web page that is of particular interest to you, you can mark it for reference later. This mark is known as a bookmark or favourite.

- To bookmark a web page, select the bookmark option in the toolbar. This will depend on the web browser software you are using. Use on-line help if you are not sure how to do this.

- You may be prompted to name the bookmark. Make sure that you use a name that will make sense to you when you come back to use it in the future.

- To open a bookmarked page select the bookmark option and select the link you want.

- It should be possible to organise the bookmarks you have created. Use on-line help to find out how to organise your bookmarks.

5. **Search engines**

- A search engine is a computer program which allows the user to find references to a keyword. It will produce a list of appropriate web pages which include the keyword you have entered.

- The results are usually listed as a series of hyperlinks with a short piece of text from the web page itself. The way that the search engine displays the results will often determine how useful it is to the user.

- When using a search engine the user can use a single word to search or can look for a combination of words which all appear in a web page. Different search engines use different syntaxes to achieve this. As you try to use a search engine you should find out how the syntax operates.

- Try using two different search engines to find information of interest to you. Here are some of the most common:

Yahoo	www.yahoo.co.uk
Google	www.google.com
Alta Vista	www.altavista.com
Ask Jeeves	www.ask.co.uk

These search engines do not all work in the same way so you will have to read the on-line help that is available to find out how to use the syntax correctly.

Investigation – Comparing search engines

Select two search engines and try searching for the same information using both of them. Write a short report comparing the search engines against the following criteria:

- response speed
- relevance of results
- presentation of results
- natural language query facilities
- elimination of duplicate links
- help facilities

Extra practice

To make sure that you can use the World Wide Web effectively you should complete the following tasks. Once you have completed each task you should write down the series of steps required to carry it out.

1. Locate the ITV homepage using its URL. Use appropriate hyperlinks from the homepage to find out what is on television tonight.

2. Use a search engine to find out about holidays in Africa.

3. Bookmark an appropriate web page on holidays in Africa.

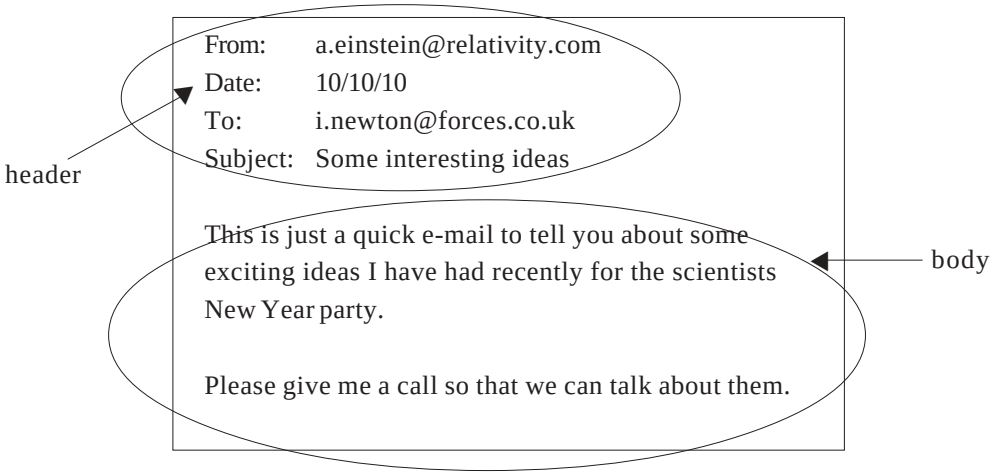
4. Alter your web browser so that the home page is one of your bookmarks (remember to change it back when you have finished!).

5. Use the back arrow to review the web pages you have downloaded.

Electronic mail

The most widely used service on the Internet is electronic mail. Electronic mail allows the user to send and receive electronic messages with anyone anywhere in the world who has access to the Internet.

An electronic mail message is made up of a header which includes the address of the sender and receiver as well as a subject and other information about the message. This is followed by the body of the text. Here is an example of a typical e-mail message:



Electronic mail was originally designed only to send and receive text. The text is encoded using ASCII so the messages tend to be quite small and do not require a lot of bandwidth to send them.

There are many reasons for the rapid growth in the use of electronic mail over recent years, but it is mainly due to its many advantages over conventional methods of sending mail.

The table below lists some of the advantages and distadvantages of electronic mail.

Advantages	***Disadvantages***
Can be retrieved at a time that suits the user	The huge increase in 'junk e-mail' has become a serious distraction
Can be sent to a number of recipients at once	Lengthy download time for complex e-mails which include attachments
May be exchanged very quickly	
Can be brief	
The text of a previous e-mail can be included for clarity	
Reduces the cost of communication	

It is now possible to add pictures, format the text and even to attach files to e-mail messages using many systems. This requires an extension to the original definition of e-mail to allow these things to be added.

Application software called an e-mail client is required to organise, edit, send and receive e-mail. You may, however, be able to access your e-mail account using a web browser as well.

The features provided by e-mail software will include the ability to do the following:

- **read** e-mail messages
- **save** messages for later reference
- **print** a hard copy of messages
- **reply** to messages
- **write** new messages
- **attach** files to messages
- **send** completed messages
- **organise** e-mail addresses
- **delete** unwanted messages

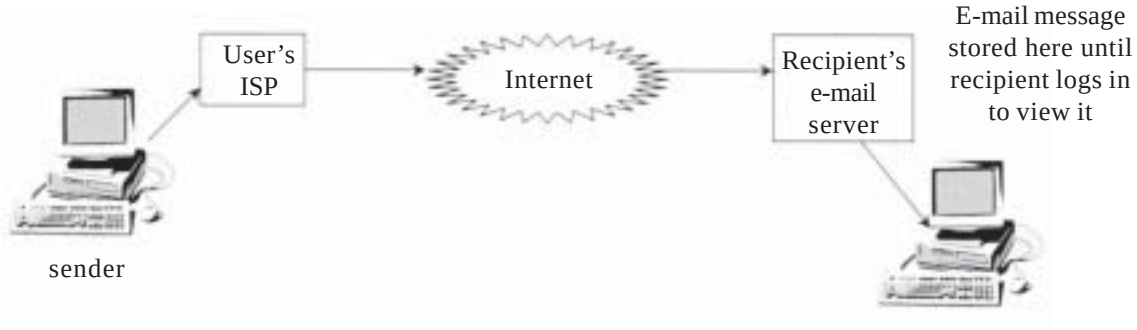
To be able to send an e-mail to someone you need to know their e-mail address. Here is an example:

joe.bloggs@myplace.co.uk

The e-mail address has three components:

- The first part is the user name. In this example it is joe.bloggs
- This is followed by the @ symbol which separates the user name from the server location
- The final part is the server name. This is usually the name of the Internet Service Provider.

When you send an e-mail message it is first sent to your ISP and then routed to the server address where it is stored in an area called a mailbox. When the person to whom you are sending the message logs on to the server they are able to download the message from the mailbox to their own computer.



Investigation

In this task you are going to find out about the functions of the electronic mail software that you have access to in school or college.

If you only have access to web based e-mail the same features should be available.

Use on-line help or other appropriate sources of information so that you can complete the table below to describe how to carry out each of these common tasks.

Feature	**Description**
Reading e-mail	
Saving e-mail	
Printing e-mail	
Replying to e-mail	
Writing e-mail	
Attaching files	
Sending e-mail	
Organising addresses	
Deleting e-mail	

Practical task on the use of electronic mail (can be used as evidence for Outcome 2)

To be able to complete this task you will require an e-mail address and access to e-mail application software or a web based e-mail service.

You are going to work as part of a group for this task.

- Create a new electronic mail message and address it to one of the other members of your group. Put the heading 'Electronic Mail' in the subject box.
- In the body of the e-mail message describe in detail the purpose of electronic mail and the structure of a typical e-mail address.
- Once you have finished send the e-mail message to the group member.
- When you receive a message from another member of the group you should review the message. You are now going to forward the message to a different member of your group. If you are not sure how to do this you should use on-line help within the software to assist you.
- Before sending the message you should add your own comments on the other person's answer to the question. If you think it requires further clarification then add this, otherwise add a note as to why you think the answer is full.
- Repeat this until every member of the group has reviewed every other member's e-mail message.

Self assessment questions

15. What is electronic mail?

16. Describe the structure of a typical e-mail address.

17. Describe how an e-mail message is transferred from the sender to the receiver.

18. What is the purpose of an e-mail **address book**?

19. What is an e-mail **attachment**?

File transfer

It is possible to download software, update software or even obtain a copy of a music file by using file transfer. We often use a web browser to do this but the process of file transfer is not the same as that used for accessing web pages. Web pages are accessed using the Hypertext Transfer Protocol (HTTP). When you are accessing a web page you will see:

http://

at the start of the URL.

When you are using the browser to carry out file transfer, the file transfer protocol (ftp) will usually be used. In this case you will see:

ftp://

at the start.

Most sites which allow file transfer can be accessed using a dedicated file transfer program or by using the functions of many web browsers.

The basic functions available are as follows:

- **Setting** the address for file transfer
- **Logging in** to the remote file server – many sites are secure and require you to have a user name and password before you will be allowed to download any files
- **Changing the directory** – this allows you to look for files in different folders on the server
- **Downloading** and **uploading** files.

Restrictions

Sometimes you may find that there are problems when using file transfer. This is particularly the case when accessing the Internet from a Local Area Network in school or college. This is due to filtering carried out by the organisation to reduce the risk of the network being infected by viruses or the downloading of inappropriate material.

Even if ftp is available to you it is important that virus protection is always enabled when using ftp as this is a common route for viruses to be downloaded to your computer.

This will be discussed in more detail in Section 3.

Practical task on file transfer (can be used as evidence for Outcome 2)

The restrictions on your Internet access within school or college might make this task impossible. Before attempting it you should check that ftp is available to you.

If you are able to use ftp, either launch an ftp program or your web browser and use the on-line help to find out how to carry out the functions described above (setting the address, logging in, changing directory, downloading and uploading files).

Find an ftp site and use its URL to log in and download a file.

Write a short report discussing the functions available in the ftp program and any difficulties involved in your experience of ftp.

Self assessment questions

20. What does **ftp** stand for?

21. What is the purpose of ftp?

22. Suggest **two** reasons why restrictions are sometimes placed on a LAN by an organisation to stop the use of ftp.

23. Why is **virus protection** necessary when using ftp?

The impact of computer networks and the Internet

So far in this section we have looked at the way we gain access to some of the services offered by the Internet.

Let us now turn our attention to the real life uses of these services and the impact they are having on our lives and on the society we are part of.

E-commerce

More and more companies and organisations are using the Internet to carry out their business or to provide a service to customers or clients.

This includes:

- **e-sales** – on-line shops selling CDs, books and DVDs and supermarkets allowing customers to order their weekly groceries which are then delivered directly to their door;
- **e-business** – banks allowing customers to view their account details or companies providing technical support for clients who have bought a particular product;
- **e-government** – government departments such as the Scottish Executive providing up-to-date information on recent laws or local authorities carrying out surveys of opinion on the development of a new road system; and
- **e-marketing** – companies advertising new products by sending e-mail messages to millions of people.

These are only some of the examples of the sorts of things that companies are currently using the Internet for.

Commerce

Before we start to try to understand what e-commerce is we should make sure that we understand what commerce is.

The dictionary defines commerce as *'the buying and selling of goods or services for money'*.

We see commerce in many forms and we use the services of commercial organisations every day of our lives, from buying a plate of chips in the canteen to buying a new computer, booking a holiday or moving house.

The advantages of e-commerce

Companies would not spend a lot of money on setting up complex web sites in order to sell their products unless they saw very clear advantages in doing so.

These advantages include:

- Reducing the cost of premises – for example a shop may not need to spend a lot of money in paying rent for a high street store.
- Speed of ordering and dispatching goods – the time required to order goods using a secure connection to the Internet is far less than sending forms via postal services.
- Reduced costs of advertising – advertising goods using web sites and mail shots using electronic mail costs a lot less than conventional published advertisements.

There are also advantages to the customer. These include:

- The ability to order goods and services at any time of the day or night.
- Many people live very busy lives and like the freedom to be able to shop at a time that is convenient to themselves.
- The cost of goods can often be cheaper using an on-line source as the reduction in costs to the company is passed on to the customer.

For these reasons e-commerce is an ever expanding use of the Internet and we are likely to see this developing further in the near future.

Economic implications

As we consider the advantages of e-commerce for the company and for the customer we must include the economic advantages of the move to e-commerce.

However, there are other economic implications which become apparent as we consider the growth of the use of computer network technology and of the Internet in particular.

Some of the implications are:

1. Where a company uses a computer network to share information and to communicate it becomes possible for people to work from home.

   Advantages
   - Less time and money spent travelling to and from work
   - Reduced levels of pollution due to lower traffic levels
   - More flexible working patterns to allow parents time with their children
   - The company can reduce the cost of office space.

   Disadvantages
   - Set-up costs for Internet access at home can be expensive in certain parts of the company
   - Personal isolation due to never leaving home
   - Difficulty of separating private and work life.

2. On-line shops can offer very fast ordering and delivery of goods.

Advantages

- No need for high street shops which are costly to run and maintain
- Staffing levels can be reduced which reduces the wage bill
- Very fast turn round of goods with no need to store goods which are not selling.

Disadvantages

- Reduction in high street shopping can have an impact on the less well off who may not have access to the Internet
- Reductions in staffing lead to increase in unemployment which has a social impact as well as an economic impact on the well-being of a community.

3. Schools and colleges utilise computer networks to share information, allow student research and improve the learning experience for students.

Advantages

- The initial costs of developing computer networks can help to improve the school environment and improve student attainment through motivation and enhanced learning chances
- The cost of expensive resources such as laser printers and access to the Internet can be shared by many users.

Disadvantages

- The costs of introducing computer networks has meant that money cannot be spent on other areas of educational development
- Maintenance costs of computer networks are high and require a lot of expensive support on an on-going basis.

Research task

There are many other examples of the economic implications of the development of the use of computer networks and it would be worthwhile spending some time looking at the advantages and disadvantages of two or three of these.

Investigation

Use the Internet or appropriate magazines to find out about three examples of e-commerce. Create a presentation about the examples you have found and share this with your group.

Self assessment questions

24. What is **commerce**?

25. Why do companies spend a lot of money on setting up an e-commerce operation?

26. Give **two** advantages to a company of e-commerce.

27. Give **two** advantages to a customer of e-commerce.

28. Describe two **economic implications** of the development of computer networks in education.

Converging technology

As you look around your home you will become aware of the impact of modern technology on the way we live. This extends from kitchen appliances such as the toaster and kettle which have a small computer chip controlling them, all the way to digital television and mobile phones.

Increasingly, technological devices are moving closer and closer together and are able to offer a range of functions. In particular, many now allow communication with other devices and direct connection to the Internet. This development is known as **converging technology**.

Here are some examples of converging technology that is currently available.

Digital television

When digital satellite television is installed a telephone connection is made to the receiver as well as to the satellite dish. This allows data such as the response to an on-line survey or the sending of e-mail to be achieved without the use of a desktop computer.

Mobile phone

As described earlier many mobile phones allow the user to access the WWW using WAP technology and a microbrowser built into the phone. This allows someone who is away from the office for an extended period to access their electronic mail.

Mobile Internet access

The use of the Internet is not just restricted to the desktop computer in the home or to the mobile phone. It is becoming more and more common to see cafes, service stations and conference centres which provide a wireless connection point for people with the appropriate hardware built into their laptop computer.

Home security systems

Many modern security systems include a telephone connection which alerts the home owner if the alarm is set off. The alarm system can then be controlled using key sequences from the mobile phone.

Wireless control of central heating

Traditionally the central heating system in a house would be controlled by a single thermostat in the living room. It is now possible to place wireless sensors in different parts of the house and for the signals from these sensors to be beamed back to a central control box which can then control the temperature in each room individually.

Wireless peripheral devices

Many peripheral devices for a personal computer can now be connected without the use of any wires. This reduces the clutter caused by computer technology in the home and allows the user to move around more freely without having to worry about wires trailing everywhere.

Activity

Watch the *Future Homes* video and write down a list of examples of converging technology featured in the video.

Self assessment questions

29. What is meant by the term **converging technology**?

30. Describe **two** examples of converging technology.

31. Give **one** advantage and **one** disadvantage of converging technology.

Code of conduct

The Internet is a huge resource which can be of great benefit in school or college and at home.

At school or college
Before being allowed access to the Internet in school or college you will probably have had to sign an **acceptable use agreement**. This is an example of a **code of conduct** which is designed to ensure that people in the school or college use the Internet in a responsible and legal way.

Just as in any other walk of life there are rules and guidelines which are there to keep us safe and to make sure that we can make the most effective use of a resource. In relation to the use of a computer network an acceptable use agreement is designed to ensure that this happens.

Investigation

Obtain a copy of the code of conduct issued to students in your school or college. Use this to answer the following questions.

- What activities are allowed when accessing the Internet in your school or college?
- What activities are prohibited in the code of conduct?
- Why do you think these rules have been set?

At home

At home, parents are often worried about what their children are up to when they are using the Internet. This is often because they don't understand what is possible but is also because of news headlines about criminal activity arising from Internet use.

Group discussion

In groups discuss the following:

- What should parents do at home to ensure children are not exposed to pornography?
- How can children stay safe when using chat rooms?
- Should parents allow children unsupervised access to the Internet? Explain your answer.

Self assessment questions

32. Why is a code of conduct an important agreement for students in a school or college?

33. What sort of activity should be controlled in schools and colleges?

Section 1 key points

- A computer network consists of two or more computers connected together to allow the sharing of data and expensive peripherals.
- A Local Area Network (LAN) is usually located in a single office or building.
- A Wide Area Network (WAN) usually uses the public telephone network to connect together computers which are spread out over a large area.
- The Internet is a network of networks.
- An Internet Service Provider (ISP) is required to connect to the Internet.
- An ISP provides e-mail addresses and web space to subscribers.
- The World Wide Web is a huge source of information stored on computers, known as servers, all over the world.
- Every web page has a unique name known as the Universal Resource Locator (URL).
- A URL is made up of a protocol, a domain name and a file name.
- A web page is a text document with hyperlinks.
- A web browser allows the user to access the World Wide Web. It may also provide file transfer and e-mail facilities.
- A microbrowser is a software application in a portable device such as a mobile phone that allows portable access to specially created web pages.
- A hyperlink is an active area on a web page that allows a user to move to another web page.
- A search engine allows the user to search for particular information on the World Wide Web.
- Electronic mail allows electronic messages to be transmitted around a computer network.
- An e-mail address is made up of the user name and the domain name.
- File transfer is used to move files from one computer to another.
- E-commerce involves the use of the Internet to do business.
- Converging technologies involves current technological developments to be incorporated into other devices such as allowing WWW access from a television.

- There are huge economic implications to business and education as a result of the growth of network technology and the Internet.
- It is important that a code of conduct is adhered to when using computer networks and the Internet.

Section 1 revision questions

1. A Local Area Network is being set up in a new school. Network points have been installed in each classroom and staff area and computers have had appropriate software installed.

   (a) What is a Local Area Network?

   (b) What extra hardware is required to allow a computer to be connected to the network?

   (c) What software will be required to allow students to access the World Wide Web?

   (d) Name **two** other services provided by the Internet which may be used by tutors in the school.

2. In order to access a web page the user requires to know the Universal Resource Locator.

   (a) What is a **Universal Resource Locator**?

   (b) Look at this example of a URL.

   http://www.mysite.co.uk/help.html

   Describe the **three** main parts of this URL.

   (c) Describe **three** ways of navigating between web pages.

3. A salesperson regularly wishes to access e-mail when she is away from the office. She uses WAP to allow access to electronic mail and important web pages.

   (a) What does **WAP** stand for?

   (b) What software is required to access the World Wide Web using a mobile phone?

   (c) What is **electronic mail**?

4. To save time going into town to do the Christmas shopping Jamie decides to do as much as possible using the Internet. He finds a number of web sites which allow him to buy DVDs and games online. Once he registers with the online company he receives advertisements from them by e-mail telling him about the latest special offers.

   (a) Give **two** reasons why Jamie might like buying CDs online?

   (b) Give **two** drawbacks to buying CDs online?

   (c) Give **two** reasons why shopkeepers in the town centre might not like online shopping.

5. At the start of the new session at Anytown High School every student has been given a form to read, sign and return to the school in relation to use of the Internet in school.

   (a) What is the purpose of this document?

   (b) Why is it important that anyone who uses the Internet thinks carefully about the way that they use it?

   (c) Why are parents sometimes worried about what their children are using the Internet for at home and at school?

6. A new television is being advertised as providing access to the Internet as well as providing the more normal television programmes that you would expect.

   (a) What is this development an example of?

   (b) Give **two** advantages of being able to access the Internet from a television.

Sample answers for Section 1 self assessment questions

1. A computer network involves the connecting together of two or more computers to allow the sharing of information and expensive peripherals and for communication.

2. A LAN is a Local Area Network. It is typically found only in a single office or building and is used to share data and expensive peripheral devices such as printers. A WAN is a Wide Area Network and is far more spread out, covering a city or the whole world. A WAN allows the sharing of data and usually uses the public telephone network.

3. Hardware such as a modem or network interface, communications software including a browser and a subscription to an Internet Service Provider are required to gain access to the Internet.

4. An Internet Service Provider provides the connection for a user to connect to the Internet. The ISP will usually also provide electronic mail addresses and web space.

5. A large organisation might set up its own ISP in order to control its access to the Internet and to reduce connection costs.

6. The World Wide Web is a huge source of information stored on computers across the Internet which a user can search to find out about any subject imaginable.

7. A browser is required to download and interpret web pages.

8. A Universal Resource Locator is the way in which each web page is uniquely identified.

9. The three components of a URL are the protocol, followed by the server name, and finally the pathname of the file on the server.

10. The home page is the web page which is automatically set to be downloaded as the soon as the web browser is connected to the Internet.

11. WAP stands for Wireless Application Protocol.

12. A mobile phone or other wireless device is used with WAP to access the Internet.

13. A microbrowser is software for a wireless device with restricted functionality and requiring limited resources. It is used to access specially modified web pages which use a restricted set of tags.

14. WML (Wireless Markup Language) is used with a microbrowser.

15. Electronic mail allows electronic messages to be sent from one Internet user to another very quickly.

16. An e-mail address is made up of the user name followed by the @ symbol and then the name of the server where the user's mailbox is located.

17. An e-mail message is transferred from the sender's e-mail application to their server and then is routed around the Internet to the recipient's server. Once it gets there it is stored in a mailbox until the recipient logs on and downloads the e-mail message.

18. An e-mail address book allows the user to organise e-mail addresses for ease of location.

19. An e-mail attachment is a file such as an image or executable program which is transferred along with the e-mail message.

20. Ftp stands for File Transfer Protocol.

21. The file transfer protocol allows large amounts of binary data to be transferred around the Internet. It is often used to allow the downloading of files, software updates or for uploading web pages to a server.

22. The use of ftp is often restricted as binary data can easily contain computer viruses which may damage the computers on the LAN, or the data downloaded may contain illegal or inappropriate material which the company or organisation do not want their employees to have access to.

23. Ftp is a very common route for viruses to attack a computer system. Virus protection should help to stop virus attacks whilst using ftp.

24. Commerce is the activity of selling products or services for money.

25. Many companies see the possibility of making a lot of money so are willing to invest in the initial costs incurred.

26. Two advantages of e-commerce to the company are the reduction in costs of maintaining high street premises and the ability to deliver goods quickly.

27. Two advantages of e-commerce to the customer are the ability to obtain the service twenty-four hours a day and the reduced cost of products which is passed on by the company.

28. The costs of developing computer networks has allowed the sharing of expensive resources such as laser printers and access to the Internet. Access to the Internet is expensive and the advantages are not always easy to see.

29. Devices which allow communication with the Internet as well as their core activity are said to be convergent.

30. Two examples of convergent technology include digital television which allows e-mail to be sent through telephone lines, and home security systems which alert the homeowner when the alarm sounds.

31. An advantage of convergent technology is the ability to use the same device for more than one task without the need for expensive computer hardware. A disadvantage might be the increased cost of devices with limited usefulness.

32. A code of conduct is a document which states what is allowed and what is not allowed when students use the Internet. It is important that students are protected when they use the Internet.

33. It is important that schools and colleges do not allow students to access material on the Internet that would be illegal.

Sample answers for Section 1 revision questions

1. (a) A Local Area Network is a collection of two or more computers in a single office or building which are connected to allow the sharing of expensive peripherals and data.

   (b) A Network Interface Card (NIC) is required to connect a computer to a network.

   (c) A browser is required to allow students to access the World Wide Web.

   (d) Electronic mail and file transfer are two other services provided by the Internet.

2. (a) A Universal Resource Locator (URL) is the unique address of every web page.

   (b) The three parts of the URL can be described as follows:

   http:// – this refers to the protocol being used to transfer the web page. In this case the protocol is the Hypertext Transfer Protocol.

   www.mysite.co.uk – this refers to the server where the web page is stored.

   Help.html – this is the actual name of the web page stored on the server.

   (c) Three ways of navigating between web pages are:

   Using hyperlinks – these are areas of text and graphics on a web page which allow the user to click and then move to another page.

   Using back and forward arrows – these buttons usually appear in the toolbar of the browser and allow the user to move to previously viewed web pages and then to move forward again.

   Entering the URL in the address box – if the user knows the address of the web page then it can be entered directly in the address box of the browser.

3. (a) WAP stands for Wireless Application Protocol.

   (b) A microbrowser is required to access web pages using a mobile phone.

   (c) Electronic mail allows messages to be transferred around the world very quickly to anyone who has access to the Internet.

4. (a) Two reasons for buying CDs online include the ease of browsing for products without having to travel to shops, and the reduced costs offered as a result of the economies available to the company not having to have expensive high street premises.

   (b) Two drawbacks of buying CDs online might include not being able to test the product before buying, and the need to have Internet access which is expensive to set up and run.

   (c) Shop keepers may not like online shopping because customers stop going to the high street as the prices offered are often lower, and the costs involved in competing with on-line shops make it hard to make a profit.

5. (a) The form is sometimes referred to as an acceptable use agreement and gives details of what is allowed and what is not allowed when using the Internet in the school.

   (b) The Internet is a huge resource which has a lot of very useful information available. It also has, however, a large amount of information which is not helpful and should be avoided. Learning to tell the difference is an important part of responsible use of the Internet.

   (c) Parents are sometime worried about children's use of the Internet as they do not understand what is possible and they have heard some very dramatic news stories about what is possible. This fear tends to lead to worry about what can happen.

6. (a) This is an example of converging technology.

   (b) Two advantages might be the ability to only have one device to do a number of things, and the possible interactivity available with many new digital television programmes which allow the user to send as well as receive.

SECTION 2

Network security

In this section you will learn about the following aspects of network security:

- Physical and software security
- Data encryption
- Filtering of content
- Potential network threats
- The need for a backup strategy.

Introduction

The advantages of being able to use computer networks for work, education and leisure are huge. They allow us to share large amounts of information and to communicate with people on the other side of the world very quickly. It is important, therefore, that data which is personal or private should be kept secure.

Physical and software security

It is possible to make it hard for anyone to gain access to a computer network by making sure that computers are not in areas where anyone can get access to them. If the door to a room is locked then it is hard for anyone to gain access without the appropriate key or security pass.

This may not be very appropriate in a busy office, so other forms of physical security can be used. A range of hardware devices can be purchased which stop an unauthorised person gaining access to the computer. Examples include putting a cover over the power switch or the keyboard. A key will be required to unlock this before the computer can be used. This form of physical security will stop most people gaining access to a computer network.

As well as physical security measures it is important to consider software security. One software security method requires the user to 'log on'. This involves entering a **user name** and a **password**. These details will have been provided by the network administrator. The user name is stored in a database on the server computer. Each user name must be

unique. When the user enters this name it is matched against the database entry to ensure the correct password is entered. If the password matches then access to the network resources will be granted.

Many network administrators insist that users change their password from time to time as this will help to ensure the security of the network.

Tasks

1. Use appropriate web pages or magazines to find out about physical security measures currently available which are designed to restrict access to a computer network.

2. Find out what security measures are used in your school or college computer rooms to restrict access to the computer network. If possible, you could find out if there are different procedures for gaining access to the network for administrators. Write a short report which clearly describes the security measures in use.

Self assessment questions

1. Why is it important to keep a computer network secure?

2. Describe **two** physical security measures.

3. Describe **one** software security measure.

4. Why must a user enter a user name *and* a password to be able to log on to a computer network?

5. Why must every user name be unique?

6. Why should passwords be changed at regular intervals?

Data encryption

Electronic mail sent from your computer should arrive at its destination very quickly and should only be available to the intended recipient. It may be possible, however, for someone to intercept the electronic mail that you have sent and read it themselves. It is a bit like an electronic postcard whose contents are open to anyone with the ability to read them. For this reason electronic mail is not a good way of sending messages which are private or include confidential information.

It is possible to make it hard to read an e-mail by **encrypting** it before sending it. This can be done so that particularly sensitive messages and files cannot be read by someone intercepting the message. Data encryption involves scrambling the text in the message so that it cannot be deciphered easily.

The **Data Encryption Standard** (DES) is a standard method of encrypting data which was originally developed by the United States Government. This specifies how an **encryption key** is used to scramble data before it is transferred. It is believed that this method is complex enough that it is not possible to decipher the scrambled data without using the **decryption key**.

Data encryption involves the following process.

1. The message is entered as normal using a text editor or electronic mail application software.

E-mail message

2. The file is opened using a special data encryption program.

3. The user enters an **encryption key**. This is a code which defines how the data will be scrambled.

Encryption key Raw text Encrypted text

4. The message is sent as normal using the electronic mail application.

5. When the message is received the same process is used to turn the message back into plain language.

Decryption key Encrypted text Original

Research task

Find out about data encryption using appropriate magazine articles or web pages. There has been a lot written about whether people should be allowed to use data encryption. Try to find some of these articles and read about the issues raised.

Write a short report about data encryption and the debate as to whether or not it should be allowed.

Practical task (can be used as evidence for Outcome 2)

Use an encryption program to prepare and send an electronic mail message to someone else in your group.

Once you have done this, prepare a short presentation which describes the process of data encryption.

Self assessment questions

7. What is the purpose of **data encryption**?

8. Why might someone want to use data encryption when sending an electronic mail message?

Legislation – The Regulation of Investigatory Powers Act 2000 (RIPA)

The rise in the use of the Internet and e-mail as an everyday method of communication has prompted the Government to make a law which allows access to data which has been protected by encryption. This law is called the Regulation of Investigatory Powers Act 2000.

A notice can be served to make a person provide information which may be encrypted where such disclosure is necessary

- in the interests of national security,
- for the prevention or detection of crime, or
- in the interests of the economic well-being of the country.

The notice must be in writing and must specify the nature of the protected information sought. The person who receives the notice will then be entitled to use the key in his possession to obtain access to the encrypted information, and then to disclose that information in intelligible form. This process will not require disclosure of the key itself. Disclosure of the key itself *may* be required, but only where there are special circumstances when to direct otherwise would defeat the object of the disclosure, and the requirement for disclosing the key is proportionate.

It is felt by many people that the power to obtain access to encrypted messages represents a significant interference with the right to private life, as well as potentially undermining the effective development of e-commerce.

Self assessment questions

9. Under what circumstances do you think an individual has the right to keep data secret?

10. What is the purpose of the Regulation of Investigatory Powers Act?

Filtering of content

The Internet is a superb source of information, for example for research to help with homework or just to find out when your favourite soap is on television.

There is, however, a large amount of content on the Internet which is inappropriate in school or college, at home or in business.

At school or college

The Internet is used as a tool to help young people learn about particular subjects or to aid with study or research skills. The range of information available is huge and most people will want to make extensive use of the Internet. However, not all of the sources of information are helpful or appropriate for children and young people to be able to gain access to.

For this reason schools and colleges will usually use software which filters all web pages and electronic mail messages before anyone can gain access to them. This may involve scanning the text in web pages or electronic mail messages for key words or blocking whole web sites which have been highlighted as containing inappropriate material.

To enable this filtering to take place, a database of banned words and web sites will be maintained and updated on a regular basis to take account of new web sites, or slang or swear words which change their meaning over time.

Some schools will not allow attachments to any electronic mail messages as these often contain viruses or pictures which cannot easily be filtered.

Investigation
Find out what filtering takes place in your school or college and write a short report describing the measures taken.

At home

Parents are often worried about what their children 'get up to' on the Internet. Some Internet Service Providers provide software which allows parents to control access to the Internet. This software is often referred to as 'parental control' software.

This software provides password control to specific web sites and allows parents to control what is allowed and what is not allowed.

Investigation

Using appropriate web sites or magazines find out about the parental control software which is provided by two Internet Service Providers with which you are familiar.

Write a short report describing the claims made by the ISPs.

In business

Employees may have access to the Internet as a necessary part of their job. The company does not want to pay its employees to spend large amounts of time surfing the web trying to book holidays or download inappropriate material.

In order to counteract this, many businesses will restrict access to the World Wide Web and also make it an obligation on employees not to download any files from the Internet.

Self assessment questions

11. What is the purpose of filtering?

12. Why do schools and colleges filter the content of web pages and electronic mail messages within the establishment?

13. What can parents do to reduce the risk of allowing their children use the Internet?

Potential network threats

In this unit you have been learning about the benefits of using computer networks. It is possible for things to go wrong and it is important that you are aware of the factors which can cause network failures.

Hardware failure

When connecting to a network there are a number of hardware devices in use. Examples of hardware include the network interface card, modem, router, etc.

If any one of these breaks down the network will not function and the user will not be able to gain access to the services provided by that network.

Many organisations employ staff whose only task is to ensure the network hardware is always available and working properly.

Software failure

As well as hardware causing problems for users of a network, the software can also cause problems.

The operating system on the server and on the client computer allows the user access to all the network resources. Before a user can log on they will usually have to enter a user name and password. All the user names and passwords are stored in a special database on the server. If the database of user names and passwords is lost or damaged no user will be able to gain access to the network. This would be a major software failure.

Sometimes the Operating System or web browser software will have to be reinstalled in order to allow communication to be re-established.

Data transmission failure

The cables used to connect computers together in a network must be of good quality to ensure data is always transmitted without error. Different types of cable can be used to reduce the possibility of data transmission failure.

An example of this might be where there is a lot of electrical interference. In these circumstances fibre optic cables could be used which are not affected by such interference. This would reduce the possibility of data transmission failure.

Data transmission failures can also occur when cables become damaged due to wear and tear or old age. It is important to ensure that all cables are in good repair in order to reduce the possibility of data transmission failure.

Physical disasters

There are other issues which can have an impact on the working of a computer network. This could be as simple as the effect of a power cut or of a fire or a flood.

The possibility of physical disasters should, therefore, always be considered when planning a new network.

Here are some questions and possible answers which ought to be thought about before a new network is installed.

Question

Where will cables be laid to make sure they are not damaged by flooding?

Answer

Cables could be laid in the roof space of a building rather than in the basement so that flood water cannot affect the cables.

Question

What would happen to files on a server if there was a fire?

Answer

The hard disk in a server could be located in a fire-tight safe and backup copies kept in a different location.

Investigation

Find out what steps are taken in your school or college to protect against:

- hardware failure
- software failure
- data transmission failure
- physical disasters.

Write a short report about your findings.

Self assessment questions

14. Give **two** examples of possible **hardware failure**.

15. What is a **software failure**?

16. Describe what is meant by a **data transmission failure**.

17. What can be done to reduce the effects of **physical disasters**?

The need for a backup strategy

Organisations depend on the security and accuracy of the data contained in their systems. It is very important that they make sure that none of the threats listed above mean that their business is disrupted for any longer than is absolutely unavoidable.

As well as making sure that hardware and software is well maintained and managed, it is important that an effective backup strategy is used. A backup strategy is a set of systematic procedures which ensure that the organisation can recover quickly following data loss.

The server can be backed up on to a secondary storage device such as DAT (digital audio tape) at night when the system is not being used. Scheduling software is used to set the start time for this procedure so that no one actually needs to be in attendance when the backup is being created. The DAT should be stored in a secure place.

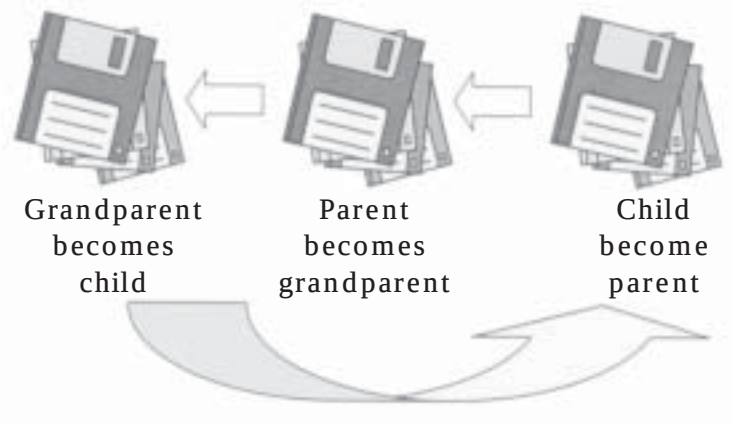
A typical backup strategy is the '**Grandparent–parent–child**' strategy. This involves the creation of three generations of backup copy.

On three successive days a backup copy is made of all the data on the server. These are referred to as the **grandparent**, **parent** and **child**.

Grandparent Parent Child

The oldest is the **grandparent** and the youngest is the **child**.

On the fourth day the disk which contains the oldest data is used again to make the newest backup copy, the child becomes the parent and the parent becomes the grandparent.



This means that there are always three copies of data covering the three most recent versions of the data. In this way an organisation will only ever lose a limited amount of data due to a network failure.

Most organisations will keep at least three days of backup copies. Many will also keep secure copies for longer – in some cases up to several months.

Practical task (can be used as evidence for Outcome 2)

Using an appropriate strategy, create a backup copy of all the data files you have created while working through this unit of work.

Once you have done this, write a short report describing how you made the backup copy and the storage medium you used.

Self assessment questions

18. Why is it important for organisations to use a backup strategy?

19. Describe the steps involved in making a backup copy.

20. Describe the **grandparent-parent-child** backup strategy.

Section 2 key points

- Physical security measures, such as keeping the computer in a locked room, are an important ways of keeping a computer network secure.
- A user should use a user name and password as a software security measure.
- Encryption allows data to be scrambled so that only those with the correct key can read the data.
- Encryption increases the security of private or confidential data.
- It is important that Internet content is filtered in school and college or at home to ensure inappropriate material is not available.
- Hardware failures, software failures, data transmission failures and physical disasters can result in loss of access to network resources.
- Data transmission errors occur as a result of problems with cables and interference.
- Good planning should reduce the effect of physical disasters.
- It is important that a backup strategy is used to ensure important data is not lost if the original is lost or damaged.
- The grandparent-parent-child strategy ensures that there are three sets of backup data at any time.

Section 2 revision questions

1. A new network of computers is being installed in a local hospital. As users of the network will have access to personal data about patients it is very important that appropriate physical and software security measures are put in place.

   (a) Describe **two** physical security measures.

   (b) Describe what users should always do to allow them to log on to the computer network.

   (c) Some of the data on the system is very private so data encryption is used as an added security measure. Describe the process of encrypting data.

   (d) Describe a hardware failure and a software failure to the network system that ought to be planned for.

2. It is important that backup copies are kept of all important data. The InverLoth Bank always ensures data is backed up at regular intervals.

   (a) Why is it important to make regular backup copies?

   (b) How often should the bank make backup copies? Give a reason for your answer.

   (c) Describe a method of making backup copies that means there will always be three copies of backup available.

   (d) Where should backup copies be kept?

3. 'PCs-R-Us' have been advertising a new software package which claims that parents should be able to allow their children access to the Internet without having to worry about what they are getting access to.

   (a) What type of software is this an example of?

   (b) Describe what filtering software does.

(c) What sort of restrictions does filtering software cause which are not intended?

(d) Do you agree or disagree with the claim of 'PCs-R-Us' about their software? Give reasons for your answer.

Sample answers for Section 2 self assessment questions

1. A computer network should be kept secure to make sure that no unauthorised person is able to gain access to private data.

2. Two physical security measures could include keeping the computer systems in a locked room or using hardware devices such as keyboard covers to restrict access.

3. The user should have to enter a user name and password before gaining access to network resources.

4. The user must enter a name and a password as the name on its own might be fairly easy to guess.

5. The user name must be unique because it identifies an individual person.

6. A password should be changed regularly to reduce the possibility of someone finding out what it is and using it for an extended period of time to gain unauthorised access.

7. Data encryption involves scrambling text so that it cannot easily be read by someone for whom it is not intended.

8. Data encryption is used to allow people to keep e-mail messages private.

9. It should be possible to keep data secret if it is of no interest to the authorities.

10. The purpose of the Act is to allow the decryption of secure e-mail to stop crime.

11. The purpose of filtering is to remove the content of web pages or electronic mail messages that is seen as inappropriate in the context of school, college, home or business.

12. Schools and colleges filter web pages and e-mail in order to reduce the amount of inappropriate or illegal material coming in.

13. Parents can install parental control software that uses passwords to restrict access to particular web sites.

14. Hardware failure could involve the server crashing, electronic failure of a modem or network interface card, etc.

15. A software failure is one which occurs as a result of the program being used to access the network not working as it should.

16. Data transmission failures occur due to problems with the medium being used to transmit the data.

17. Good planning in the installation of the network and good strategies for backup can help to reduce the effects of physical disasters.

18. A backup strategy is important so that the organisation does not lose vital time and money if there is a problem with the computer system which results in data being lost or damaged.

19. The steps involved in creating a backup copy are (1) select the original data to be copied, (2) copy the data to a different storage device such as re-writable CD, (3) store the backup copy in a safe place which is in a different location from the original.

20. A backup copy is made and stored in a safe place. On the following day another backup copy is made. This is the child. The backup made on the previous day becomes the parent copy. On the next day a further backup copy is made. The current child becomes the parent, the parent becomes the grandparent and the newest backup is now the child. On successive days, a backup copy is made so there are always three generations of backup copy in existence.

Sample answers for Section 2 revision questions

1. (a) Two physical security measures could include keeping the computer in a locked room so that only those with an appropriate key can get anywhere near the computer. Other physical security measures include keyboard locks which cover the keyboard and can't be removed without the appropriate key.

   (b) Users should always have to enter a user name and password to be able to log on to a network.

   (c) To encrypt data a special program is used which takes the text to be encrypted along with a key provided by the user to scramble the text before it is sent. The recipient must also have a key in order to unscramble the text at the other end.

   (d) Physical failures include hard disk crashes, cabling problems, etc. Software failures include the server crashing, the database of user names being lost, settings for access rights being altered, etc.

2. (a) Regular backup copies should be made in case the original is lost or damaged.

   (b) Backup copies should be made at regular intervals. In the case of the bank this should be done every day as there a lot of transactions every day and they would not want any of these to be lost.

   (c) The grandparent-parent-child backup strategy could be used to ensure that there are always three copies of the data covering the most recent three days. (See page 50 for a full description.)

   (d) Backup copies should always be kept in a different location from the original as the reason the original was damaged could also damage the backup if they are kept in the same place.

3. (a) This is an example of filtering software.

(b) Filtering software scans all e-mail messages and web pages for words which are contained in a special list. If any of the words match then the web page or e-mail message will be blocked.

(c) Unexpected restrictions often occur when words with perfectly innocent meanings are made up of other words which appear on the banned list.

(d) Software on its own can never stop all inappropriate material being accessed. It is important that all Internet users learn to think about their own use and not to depend on filtering on its own.

SECTION 3

Data transmission

In this section you will learn about the following aspects of data transmission.

- the main types of transmission
- dual use for voice and data
- wireless communication methods
- connections to the Internet
- hardware requirements for a wireless network.

Introduction

When thinking about the use of a computer network the user is not usually aware of how the data is transmitted between the server and the client. In this section we will look at a number of different ways in which data is transmitted.

Types of transmission

When data is transmitted around the Internet it can be sent to one individual client, a specific group of clients or to anyone who wishes to access it.

Unicast

When you send an e-mail message to your aunt in Australia to tell her how much you appreciated her Christmas present, you are transmitting that data using a **unicast** method. This means that there is only one recipient for your message.

Broadcast

If data is transmitted to anyone who wishes to receive the data it is known as **broadcast**. We are used to broadcast transmission with television. The signal is transmitted and anyone with a receiver can watch the television programme.

This is utilised widely with Internet radio stations and audio or video streaming.

Multicast

If you send a single e-mail message to a number of people at the same time it is known as **multicast**. An example of multicast would be the use of videoconferencing. In this example the image of one person is transmitted over the Internet to a number of other users. Another example might be the periodic issuing of an e-mail newsletter.

Self assessment questions

1. Describe the three main types of **transmission** of data?

2. What is the difference between **broadcast** and **multicast** transmission?

3. Give an example of **unicast** transmission.

Voice and data transmission

Both Local Area Networks and Wide Area Networks are often used to transfer computer data and voice signals at the same time.

Local Area Networks

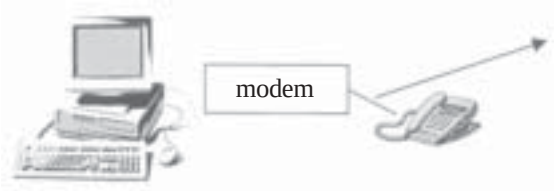
The cables which provide the network communication within an office or organisation can be used for the internal telephone network as well.

This can be very useful as only one set of cables needs to be installed for both computer data and voice communications.

Wide Area Networks

Computers connected to a Wide Area Network use the public telephone network to allow the transfer of data.

One way of connecting your home PC to the Internet involves using a modem and a normal telephone line. The digital signal from the computer is converted to an analogue signal using the modem. The modem is then connected to a telephone line.



In this example the telephone line is shared and can only carry one stream of data, either the phone message or data from the computer. With ISDN (Integrated Service Digital Network) or ADSL (Asynchronous Digital Subscriber Line), the phone line can carry both of these at the same time.

These methods of connecting to the Internet will be discussed in more detail in Section 4.

The Internet backbone can carry data files, video and voice simultaneously.

Self assessment questions

4. Why do offices often use the same cables for computer networking and voice communications?

5. What are the cables in a Wide Area Network mostly used for?

Wireless communication methods

Although data is usually transmitted around a computer network which involves the use of cables, it is becoming more and more common to be able to connect to a computer network using wireless technology.

The main aim of wireless networking is to allow greater flexibility for the person using the computer network. The clutter of cables in an office or at a computer workstation can be drastically reduced and the user is not always tied to a single place.

There are three main types of wireless network that we will look at in this unit.

Wireless Personal Area Network (WPAN)
This form of network will usually be in a fairly small area. For example, a laptop computer, personal digital assistant and portable printer could all be connected together without having to plug anything in. This would allow a single user to access different devices

Investigation

Bluetooth is one example of a standard method of setting up a WPAN.

Use appropriate magazines or web sites to find out about Bluetooth or another wireless method of networking.

Write a short report about how such a network can be set up and used. Try to find out about the restrictions of the system such as range and speed of access.

Wireless Local Area Network (WLAN)

The main difference between a WPAN and a WLAN is that a WPAN is usually centred on an individual person whereas a WLAN allows multiple users. In other words a WLAN is usually set up in a single office to allow a group of users to share resources and transfer data.

WPAN and WLAN both use infrared signals to transmit data.

Wireless Wide Area Network (WWAN)

When connecting together computers over a wider area it is possible to use a microwave connection. In this situation each Local Area Network is connected to a microwave transmitter and receiver to create a single wireless Wide Area Network. To use these devices 'line of sight' is usually required for effective transmission of data.

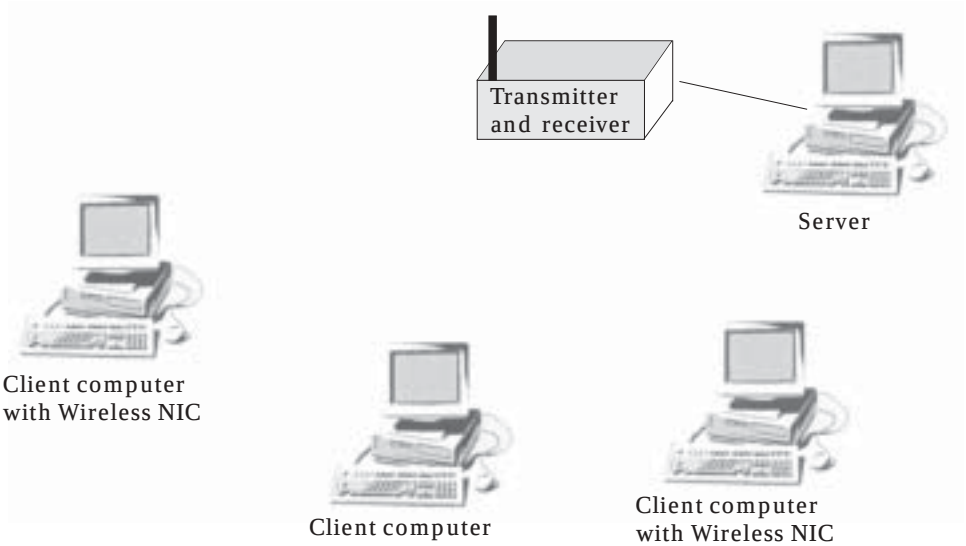
In general, the higher the bandwidth the shorter the range of transmission for a wireless WAN.

Newer technology which enables the use of mobile phone technology allows a user to connect to the Internet from a laptop or palmtop computer anywhere which is within range of a mobile phone cell. This makes the use of wireless Wide Area Networks very flexible indeed. The main disadvantage of a system such as this is the cost which tends to be quite high.

Hardware for wireless connection

A computer requires a Network Interface Card (NIC) to allow it to be connected to a Local Area Network. If a wireless connection is being made then a special NIC known as a Wireless Network Interface Card is required. This will be considerably more expensive than the more normal NIC.

As well as the Wireless Network Interface Card a **transmitter** and **receiver** will be required to allow communication to take place between the computer and the server.



Self assessment questions

6. Give **two** advantages for the user of **wireless communications**.

7. What is a **Wireless Personal Area Network**?

8. What is the main difference between a **Wireless Personal Area Network** and a **Wireless Local Area Network**?

9. What extra **hardware** is required for wireless communication?

Connecting to the Internet

To access the Internet you will need to use one of the following types of connection:

- dialup modem
- ADSL
- ISDN
- cable modem
- leased line

Let us look at each of these methods of connection.

Dialup modem
A modem is a hardware device which allows computers to transfer data over the public telephone network. The digital signal generated by the computer must be translated into an analogue one before it can be transferred.

This is the slowest way of connecting to the Internet but is still commonly used where other options are limited.

ADSL
ADSL stands for **Asynchronous Digital Subscriber Line**.

This form of connection uses a normal telephone line but the computer data can be transmitted at the same time as the telephone is used The data transfer rate is far higher than using a dialup connection. This is one of the main forms of connecting to the Internet which is given the name **broadband** due to the high speed data transfer rates possible.

Not all areas can use ADSL as alterations have to be made to the telephone network to make it work. The telephone companies will only make these alterations if there is a large enough number of people wishing to connect to the Internet using this method. You can find the current coverage of ADSL by looking at www.bt.com/broadband

ISDN
ISDN stands for **Integrated Services Digital Network**.

This is an international data communications standard which allows data and voice to be transmitted down a single communication channel. There are a number of different versions of ISDN which provide different rates of data transfer.

ISDN is faster than a dialup connection but not usually as fast as a broadband connection.

Cable modem

Cable television providers will usually be able to provide access to the Internet using spare capacity not used for TV channels. A hardware device known as a **cable modem** is used to connect the computer to the cable network. Data transfer rates are generally very high and equivalent to ADSL data transfer rates.

This form of connection is only possible where cable television providers have cables to supply cable TV. People wishing to use this form of Internet connection usually have to subscribe to television services or telephone services along with the Internet service.

Leased line

Some organisations will pay the telephone provider for a telephone line which can only be accessed by that organisation. This is a permanent connection between two places and can be useful if the organisation wants to ensure that data being transmitted across the network is kept secure.

The company will have to pay a fixed monthly fee for the leased line which is always connected, unlike a dialup connection which is only connected when using the Internet.

Research task

Draw up a table like the one on the next page and use appropriate magazines or web sites to find out as much as you can about each method of connecting to the Internet.

For each method you should give an advantage and disadvantage of connecting to the Internet in this way.

Connection type	Typical speed	Costs	Advantage	Disadvantage
Dialup modem				
ADSL				
ISDN				
Cable modem				
Leased line				

Broadband

The term broadband is a term often used to describe Internet access which is faster than a conventional dialup connection. It is a general term which does not refer to any one particular way of connecting to the Internet.

As described above, ADSL and cable modem connections are typically described as broadband connections.

Broadband connection are said to be 'always on'. This means it is not necessary to dial in whenever you wish to use the connection as with a dialup connection.

Self assessment questions

10. Describe the **five** main ways of connecting to the Internet.

11. What is meant by the term **broadband**?

12. If you wanted to connect your personal computer at home to the Internet, which of the five main methods of connection would you use? Give reasons for your answer.

Section 3 key points

- The three main types of data transmission are unicast, broadcast and multicast.
- Networks can be used for data and voice transmission.
- A Wireless Personal Area Network allows the user to connect together a number of devices such as a computer, printer, keyboard and mouse without the use of any cables.
- Computers can be connected together using Infra Red links to created a Wireless Local Area Network.
- Microwave or mobile phone technology can be used to connect together computers in a Wireless Wide Area Network.
- To be able to use a Wireless Local Area Network, the network requires a receiver and transmitter, and each computer needs a wireless network interface card.
- A computer can be connected to the Internet using dialup, ADSL, cable modem, leased line or ISDN.
- A dialup connection requires a telephone line and a modem to convert the digital signals from the computer into analogue ones which can be transmitted over the public telephone network.
- ADSL stands for Asynchronous Digital Subscriber Line and allows high speed data transmission using the same line as the conventional telephone.
- A cable modem allows a computer to connect to the Internet using spare channels in a cable television system.
- ISDN stands for Integrated Services Digital Network and allows communication over a special line which is faster than dialup.
- A leased line allows a company to connect together computers over a private line which is always connected.

- A broadband connection to the Internet is any one which provides high speed access.

- ADSL and cable are examples of broadband connections to the Internet.

Section 3 revision questions

1. An international company has offices in America, France and Scotland. It is very expensive to organise meetings so electronic communication is very important.

   (a) What form of transmission is used when the managing director sends an e-mail to all the office managers? Explain your answer.

   (b) Once a month the sales staff set up a video conference to discuss current issues. What form of transmission is used in this situation? Explain your answer.

   (c) David works in the finance department in Scotland and needs figures from his counterpart in the office in France. He uses e-mail to request the information. What form of transmission is being used in this situation? Explain your answer.

2. Julie has persuaded her mum to get their household computer connected to the Internet but her mum is confused by the variety of different types of connection. She visits the local computer shop who suggest that she should consider an ADSL connection as this will give her broadband access to the Internet.

   (a) What is meant by the term **broadband**?

   (b) What does **ADSL** stand for?

   (c) Do you agree that ADSL would be the best option for Julie's mum? Give a reason for your answer.

   (d) Describe one other method of connecting to the Internet which would provide broadband access.

3. West Anywhere Council are installing a new network in one of its offices. They decide to set up a Wireless Local Area Network in order to reduce the amount of cabling required.

   (a) What is a **Wireless Local Area Network**?

   (b) What extra hardware is required to set up a Wireless Local Area Network?

(c) What is the difference between a Wireless Local Area Network and a Wireless Wide Area Network?

4. A doctor uses a laptop computer connected to a Local Area Network in the surgery in order to access data about patients. When making house calls a palmtop computer is used to take notes which are then used to update the database in the surgery. The palmtop does not need to be plugged into the Local Area Network in order to allow the doctor to print documents or to update the main database.

(a) Why does the doctor not need to plug the palmtop computer into the Local Area Network?

(b) What type of network is created when the doctor connects the palmtop computer to his laptop computer?

(c) Describe two advantages of not having to use any wires to connect the palmtop computer to the laptop.

5. A travel agent has offices in two towns. It is important that all bookings are kept up to date so a permanent connection is maintained between the computers in the two offices.

(a) Describe the most appropriate method of connecting these two computers.

(b) Give another reason for using this form of connection between the two computers.

(c) Is this an example of a Local Area Network or a Wide Area Network?

Sample answers for Section 3 self assessment questions

1. Unicast involves data being sent from one computer and received by a single computer. Broadcast involves data being sent by one computer and being received by anyone. Multicast involves data being sent by one computer to a number of other computers.

2. Broadcast data can be received by anyone whereas multicast can only be received by a number of individually identified people.

3. An e-mail message sent by one person and received by another is an example of unicast.

4. Only one set of cables will be required to share voice and data communications which reduces the cost of installation.

5. The cables in a Wide Area Network were originally installed for voice communication as they make up the public telephone network.

6. Advantages of wireless communication include the flexibility to move about without having to worry about the position of the cables, the lack of clutter as a result of cabling and the ease with which a new network can be set up in an office.

7. A Wireless Personal Area Network allows a single user to connect together devices such as a laptop, palmtop and printer without the use of any cables.

8. A WPAN is used by a single person whereas a WLAN allows a group of users to share resources.

9. A Wireless Network Interface. Receiver and transmitter are the additional hardware items required.

10. The five main ways of connecting to the Internet are:

    Dialup – using a modem and telephone line
    ADSL – stands for Asynchronous Digital Subscriber Line, and allows very fast connection over the telephone network
    ISDN – stands for Integrated Services Digital Network, and allows faster connection than dialup
    Cable – a special modem is required to connect using spare capacity in a cable television network

Leased line – a permanent connection between computers over a telephone connection which is private.

11. Broadband refers to a connection to the Internet which provides fast data transfer and which is 'always on'.

12. A home user might use a dialup connection due to the ease of connecting and relatively low costs involved. More and more people, however, are using broadband connections which provide an 'always on' service at a cost which is often bundled with the cost of cable television or another telephone service.

Sample answers for Section 3 revision questions

1. (a) Multicast transmission of data is used as the message is being sent to a number of recipients.

   (b) Multicast is used as the video image appears on a number of other terminals to allow the conference to take place.

   (c) An e-mail message sent to one other person is an example of unicast.

2. (a) Broadband refers to an Internet connection which is always on and provides fast data transfer rates.

   (b) ADSL stands for Asymmetric Digital Subscriber Line.

   (c) ADSL may be the best option as she will be able to access broadband technology without the need to subscribe to other services such as cable television. There are, however, areas where ADSL is not available and she should check this before going any further.

   (d) Cable television providers use spare capacity not used for television channels to supply broadband Internet access. A cable modem is used to connect the computer to the cable television system.

3. (a) A WLAN is set up in a small area and provides the same services as a conventional LAN without the need for cabling.

   (b) A wireless network interface card is required in each computer and a receiver and transmitter is required.

   (c) A WWAN is generally based around the use of mobile phone technology or microwaves and is currently expensive to set up and run.

4. (a) The doctor is using a wireless connection between the palmtop and laptop computers.

   (b) This is an example of a Wireless Personal Area Network (WPAN).

   (c) The WPAN provides greatly flexibility as the doctor can move

the palmtop computer around without the cables trailing everywhere. The clutter of cables is reduced thus making a more user friendly working environment.

5. (a) A leased line would be used as this provides a constant secure connection between the two offices.

(b) The connection can be kept private whereas connecting to the Internet tends to be fairly insecure.

(c) This is an example of a Wide Area Network as the computers are spread over a large area.

SECTION 4

Network protocols

In this section you will learn about

- name services
- DNS.

Introduction

In your experience of using the World Wide Web you will have downloaded a wide number of different web pages from servers situated in many different parts of the world.

You should remember from Section 1 that each web page has a unique name known as its **Universal Resource Locator** (URL).

Here is an example:

www.ltscotland.org.uk/index.html

The first part of this URL is known as the **domain name**. This identifies where the web page is stored. Each domain name may refer to a number of different **host** computers where the web pages are physically stored.

Every domain name has a suffix which indicates which Top Level Domain (TLD) it belongs to. Here is a reminder of some of the most common ones.

Suffix	Meaning
.com	a commercial company
.net	a network organisation
.org	an organisation such as a charity (usually non profit making)
.gov	a governmental organisation such as the Scottish Executive or parliament
.sch	a school
.ac	a university or college of further or higher education
.mil	military

If you were to look closely at the data from a web page as it was transferred from the server to your computer you would not find any mention of this domain name. Instead, each host has its own numerical address which is a collection of four numbers by which it is identified.

Here is an example of what this data might look like:

105.72.33.10

Note
This collection of numbers is known as an IP address and takes a different form depending on the type of host. We will not, however, look at the meaning of the IP address in this unit of work.

The name is not transferred as it is very long and could very easily give rise to error. The IP address, however, is only four bytes long so is far faster to transfer. Also, the data may be moved to a different computer but should still be accessible using the same URL.

There has to be a translation of the URL that we enter in the web browser into the IP address that is actually used by the Internet to identify the computer where the page is stored and then to fetch it. This is known as a **name service** and allows the **resolution** of the name into its matching IP address.

Domain name service

The Domain Name Service (DNS) is responsible for taking the URL entered by the user and identifying the correct server where the web page is stored.

The following steps are carried out:

1. The user enters a URL in the web browser.

2. The web browser accesses the database provided by your Internet Service Provider and looks up the domain name. If the domain name cannot be found in its database a link is made to another database and the name is looked up there. This is repeated until the name is found.

3. The address is matched in the database to the IP address which is then used to identify the correct server where the web page is stored. This is known as **host name resolution**.

A domain is a group of computers on a network that are administered as a common group with the same rules and procedures. A host is a computer system that is accessed by a user from a remote location. Each host has its own unique IP address.

Domain names and e-mail addresses

In this section we have only referred to finding and downloading web pages.

You should realise that when we are discussing domain names in relation to web pages exactly the same principles apply when the destination for an electronic mail message is being located.

The domain name part of the e-mail address must be resolved to find the host where the mailbox is located.

Self assessment questions

1. What is a **domain**?

2. What is a **host**?

3. Why is the actual name not transmitted with the data in a web page?

4. Describe the process of **domain name resolution**.

Practical task

Ask your teacher for the IP addresses for a number of hosts. Use your web browser to see if you can find out the host name by entering the numbers directly into the address box of your web browser.

To find IP addresses you can use a site such as:

http://cello.cs.uiuc.edu/cgi-bin/slamm/ip2name

Create a table like the one below to show the match between some IP addresses and the actual domain names.

IP address	Domain name

What happens when you enter the numbers rather than an actual address?

What do you think is happening?

Investigation

Use appropriate magazines or web sites to find out about the Domain Name Service.

Write a short report describing how it works.

Include some examples of host names and their IP addresses.

Section 4 key points

- Every host has its own domain name which is used to identify it.
- The host name is resolved into an IP address to identify it.
- The Domain Name Service (DNS) takes a host name and looks it up in a distributed database maintained by the Internet Service Provider in order to resolve the name.
- Resolution of e-mail addresses operates in the same way as web pages.

Section 4 revision questions

These revision questions make reference to some of the material in earlier sections. Do not attempt these questions until you have completed all the sections in this unit of work.

1. Susan wants to use the Internet to find information about the films currently being shown at her local cinema.

   (a) Which service of the Internet is she most likely to use?

   (b) What software will she use to access this service?

   (c) Describe two ways that Susan could find the information she is looking for.

   The address of one of the web sites Susan finds appears as a series of numbers rather than the more usual web address.

   (d) What are these numbers?

   (e) Describe how the domain name is translated into these numbers.

2. Sandy wants to send an electronic mail message using the **microbrowser** on his mobile phone using **WAP**.

(a) What is a microbrowser?

(b) What does WAP stand for?

(c) Describe **one** other service provided by the Internet that Sandy could access with the microbrowser.

(d) The electronic mail message is sent to a number of different people. Is this an example of unicast, multicast or broadcast?

(e) When Sandy tries to send the e-mail message he receives an error message to tell him that the domain cannot be found. What service has been used to provide this information?

3. An Internet Service Provider allows users to use its own search engine to look for information on the World Wide Web.

   (a) Describe **two** other methods of navigating web pages.

   (b) When a user enters a **URL** the ISP provides a service which translates this into an **IP address**.

      (i) What is an IP address?

      (ii) What is a URL?

      (iii) How is the URL translated into an IP address?

4. An on-line company offers to register **domain names** for a single monthly fee.

   (a) What is a **domain name**?

   (b) What is the difference between a **domain** and a **host**?

   (c) Which part of the example address shown below gives the domain name?

      http://www.interestinginfo.net/files/index.html

   (d) Give **two** examples of Top Level Domains.

   (e) Describe **two** ways in which a user can find web pages which have been stored on a particular host.

5. Liz works for a firm of architects involved in the development of a number of major new buildings. She wants to be able to transfer data from her desktop computer to a palmtop which she can take with her when she goes out on site visits. Some of the data stored in the palmtop is private so security is important.

   (a) How can the data be transferred between the desktop computer and the palmtop without the use of any cables?

   (b) What is the name given to this type of network?

   (c) Describe how Liz can ensure that no one can read the private data stored on her computer.

(d) What regulation covers this approach to keeping data secure?

When out on a site visit Liz can access her own desktop computer by connecting her palmtop computer to a mobile phone. She can then take photographs using a digital camera and let everyone else in the office see what stage the project is at.

(e) What type of network is this?

(f) What service provided by the Internet is used to send the digital pictures back to the office network?

Sample answers for Section 4 self assessment questions

1. A domain is a group of computers on a network that are administered as a common group with the same rules and procedures.

2. A host is a computer system that is accessed by a user from a remote location. Each host has its own unique IP address.

3. The name of the domain is not transmitted with the web page as it is the IP address which signifies the page itself.

4. Domain name resolution involves matching the domain name against its IP address in a special database stored by the ISP.

Sample answers for Section 4 revision questions

It is assumed that you will have tackled Sections 1 to 3 before attempting the Section 4 questions. If you have not done so then you should leave these until completing the other sections.

1. (a) She is likely to use the World Wide Web.

   (b) She will use browser software.

   (c) The information could be found by using a search engine and entering keywords or by clicking hyperlinks from the home page.

   (d) The numbers are the IP address.

   (e) A database of domain names stored by the ISP is searched until a match is found. Once this match has been found the corresponding IP address is found.

2. (a) A microbrowser is software which allows access to the World Wide Web from a mobile device such as a mobile phone.

   (b) WAP stands for Wireless Application Protocol.

   (c) He could access e-mail using the microbrowser which would allow him to send and receive electronic mail messages.

   (d) This is an example of multicast.

   (e) The Domain Name Service is used to find the name so that it can be matched to its IP address.

3. (a) Two other methods of navigating web pages could include using hyperlinks in web pages or entering the URL directly in the address box of the browser.

   (b) (i) The IP address is a series of four numbers which identifies the host computer wherever it is on the Internet.

   (ii) A URL or Universal Resource Locator is the unique address of any web page.

(iii) The URL is passed to the DNS which tries to make a match. Once it does this the IP address is then used to find the web page.

4. (a) A domain name is the name given to a particular organisation with a presence on the World Wide Web.

(b) A domain identifies the organisation whereas a host is the actual computer where the web pages are stored.

(c) www.interestinginfo.net signifies the domain.

(d) Examples of TLDs include .com, .gov, .net, .org, .sch, etc.

(e) Two ways in which a web page can be found could be to use a search engine or to click on hyperlinks from the site home page.

5. (a) A Wireless Personal Area Network can be set up with a Wireless NIC to transfer the data.

(b) This is known as a Wireless Personal Area Network (WPAN).

(c) The data could be encrypted using a key to scramble the data.

(d) The Regulation of Investigatory Powers Act 2000.

(e) This is a Wireless Wide Area Network (WWAN).

(f) File Transfer is used.

APPENDIX

Intermediate 2 Computing

Computer Networking

Introduction

There are four sections:

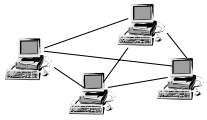
1. Network Applications
2. Network Security
3. Data Transmission
4. Network Protocols

Section 1

Network Applications

What is a Computer Network?

A computer network consists of two or more computers connected to allow the sharing of expensive peripherals or data.



LANs and WANs

There are two main types of computer network:

•A Local Area Network (LAN) is usually in a single office or building.

•A Wide Area Network (WAN) can be spread over a very large area and usually uses the public telephone network to transfer data.

The Internet

- The Internet is a form of Wide Area Network
- It is actually a large collection of networks, or a network of networks.

Accessing the Internet

To access the Internet appropriate hardware, software and an Internet Service Provider (ISP) are usually required.

Hardware – computer, modem or cable modem, cabling

Software – Communications software

The World Wide Web

- The **World Wide Web (WWW)** is a huge source of information stored on computers all over the world.
- These computers are called **servers**.
- A **web browser** is used to access web pages.
- A web browser can also often be used to access email and file transfer.

What is a Web Page?

- A **web page** is a text document formatted using special tags.
- A web page can include text, graphics, hyperlinks and other multimedia elements.
- The language used is called **Hypertext Markup Language** (HTML).
- Each tag is identified by < > symbols.

Mobile Access to the Internet

- It is possible to gain mobile access to the Internet from some devices such as mobile phones.
- A special protocol called **Wireless Application Protocol** (WAP) is used.
- Mobile devices use software called a **microbrowser** to access specially formatted web pages.

Navigating the WWW

It is possible to navigate between web pages using a number of different methods:

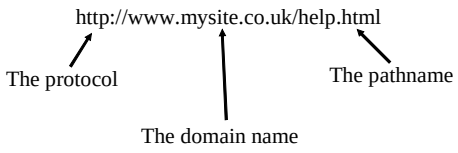
•Clicking hyperlinks

•Back and forward arrows in browser

•Entering URL in address box

•Using search engine

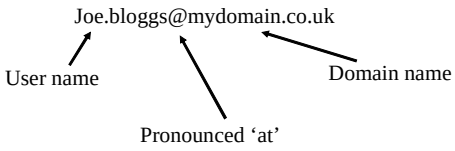
The Structure of a Web Address



Electronic Mail

- Electronic messages can be transferred around the world using electronic mail.
- Each user must have an email address and access to the Internet.

Structure of an email Address



File Transfer

- File transfer allows files such as pictures and executable programs to be transferred electronically.
- The **File Transfer Protocol** (ftp) is the most common method of carrying out file transfer.
- A special program called an **ftp client** or a browser can be used to transfer files

E-commerce

- The carrying out of business or providing a service using the Internet.
- This includes:
  - e-sales
  - e-business
  - e-government
  - e-marketing

Advantages of e-commerce

- Reducing the costs of premises
- Speed of ordering and dispatching goods
- Reducing the costs of advertising
- Ability to order any time of day or night
- Reduced cost of goods

Implications of e-commerce

- Possible to work from home
- Fast ordering and delivery of goods
- Sharing information

Converging Technology

- Devices which incorporate networking technology
- Includes:
  - Digital television
  - Mobile phones
  - Mobile Internet access
  - Home security systems
  - Central heating
  - Wireless peripherals

The Regulation of Investigatory Powers Act 2000

- Allows authorities to access encrypted electronic mail messages
- access allowed if
  - In the interests of national security
  - For the prevention or detection of crime
  - In the interests of the economic well being of the country

Code of Conduct

- Protect against inappropriate use of the Internet at
  - School or college – reduce access of inappropriate material
  - Home – alleviate parental worries

Section 2

Network Security

Physical Security

Restricts access to a computer which is connected to a network by

•keeping it in a locked room

•providing a lock on the keyboard or power switch

Software Security

- To restrict users' access to a network they should always have to log on using a unique user name and password.
- Passwords should be changed regularly.

Data Encryption

- Electronic mail is not private.
- To make message more secure data can be scrambled using special software
- A 'key' is used to encrypt and encrypt and decrypt the message

Filtering Content

- To reduce access to inappropriate material schools and colleges and commercial organisations often use filtering software to 'block' web pages and e-mail messages containing banned words.

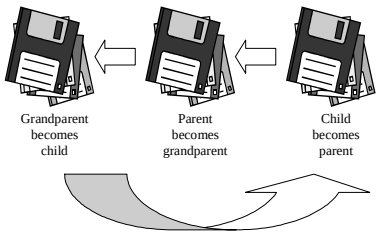
Potential Network Threats

- Hardware failure – hardware devices must be maintained properly
- Software failure – software on server can crash
- Data transmission failure – electrical interference, problems with cables
- Physical disasters

Backup Strategy

- A backup copy should always be kept in a safe place in case the original is lost or damaged.
- Backup copies should be made regularly.

Grandparent-Parent-Child



Section 3

Data Transmission

Types of Transmission

- Unicast – data sent by one computer to one other computer.
- Multicast – data sent by one computer to a specified group of others.
- Broadcast – data sent by one computer which can be accessed by any other.

Voice and Data Transmission

- Voice and computer communications often take place over the same network cables.
- This reduces costs of networking for a Local Area Network.
- The public telephone network is the basis for Wide Area Networks

Wireless Communication

- It is possible to set up networks without any wires at all.
- Wireless Personal Area Network (WPAN)
- Wireless Local Area Network (WLAN)
- Wireless Wide Area Network (WWAN)

Connecting to the Internet

- Dialup – slow access using a modem
- ADSL – Asynchronous Digital Subscriber Line to provide broadband access
- ISDN – Integrated Services Digital Network provides faster than dialup access
- Cable modem – used to connect to cable television network to provide broadband access
- Leased line - a dedicated telephone that is only used by the organisation paying for it

Broadband

- A connection to the Internet which is ‘always on’ and provides fast access is known as broadband.
- ADSL and cable are two examples of broadband access to the Internet.

Section 4

Network Protocols

Domain Name

- This identifies the organisation which stores the web page
- A number of Top Level Domains (TLD) provide information about the type of organisation:
  - .com
  - .gov
  - .sch
  - etc.

Domain Name Service

- The Domain Name Service (DNS) is responsible for taking the URL entered by the user and transforming it into the appropriate IP address.
- The IP address is a series of four numbers, for example:
  - 124.32.43.12