A textbook for Year 12

Computer Studies

COMPUTER EDUCATION

YEAR 12

2015

Technology and Employment Skills Training
Ministry of Education, Fiji.
28th November 2014

Preface

This text book has been written to cater for the new Year 12 Computer Education syllabus trialed in Fiji secondary school for the year 2015. It is a new text book and the first of its kind to be written locally.

It is hoped that this book will be useful in implementing the syllabus but it should be understood that it is not the syllabus. The syllabus is the framework for the teacher to follow while this text book is a resource for the student. Therefore departure to other resource materials for more information will be acceptable.

The text book is not the perfect piece of work as it has been prepared in a very short time, therefore suggestions for amendments will be welcomed. It is anticipated that this book will minimize the amount of time for teachers in lesson preparation and more time will be devoted to actual classroom teaching and learning.

There may be a variety of opinion about the content of the topics, but for the beginner it is the best which gives the time and opportunity to become familiar with the basics before pursuing further into the field of study in greater detail at the upper secondary level.

Ministry of Education,
Suva.
Fiji Islands
28th November 2014.

Acknowledgement

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Every effort has been made to acknowledge all copy right.

Contents

Chapter 1 

The Internet and the Web

Internet: network of networks
WWW: multimedia interface

After completing this chapter, you will be able to:

1. Differentiate between internet and WWW
2. Discuss the effects of cyber culture
3. Identify and compare different search tools
4. Describe different web technologies

1.0 Introduction

There has always been a misconception between the terms internet and the World Wide Web (WWW). Most people think it is the same thing. This chapter will clearly show the major difference between the internet and the WWW. Internet today can support various kinds of applications and communications. Searching information over the internet has become ever so easier with the search tools that are available. People all over the globe are connected via the internet. Communication over the internet now is as easy as talking to a friend sitting beside you. This is explained further with use of web utilities and social networking. Web utilites provide users a convenient way to interact with internet whether for business or personal use.

From small sized to large business organizations and the people in general, all benefit with the advancement of internet technology. However, there has also been a negative side to this huge growth in internet. A huge increase in internet related crime is becoming common. This is known as cyber-crime. Some cyber-crimes are discussed under the disadvantages of internet.

1.1 The Internet and WWW

Internet is simply a network of networks. It is the actual physical network that spans the entire globe. It is made up of computers, handheld devices, cables, switches, routers, satellitesand wireless devices. Everything that can be accessed on/from the internet is known as resources. These resources are simply stored on some devices usually known as servers. Servers are computer with huge storage and processing capabilities.

The World Wide Web simply provides means and ways to access the internet's resources. It gives a multimedia interface whereby we can easily interact with the resources that are available on the internet. Multimedia is a combination of various forms of media. For example: animations such as growing/shrinking text, hypertext, sound, images and videos. WWW organizes information by using hypermedia. Interface is a way of interacting with these media, usually by clicking on hyperlinks or simply on images to view or save it on your computer. Figure 1.1 below shows the structure of the internet web.

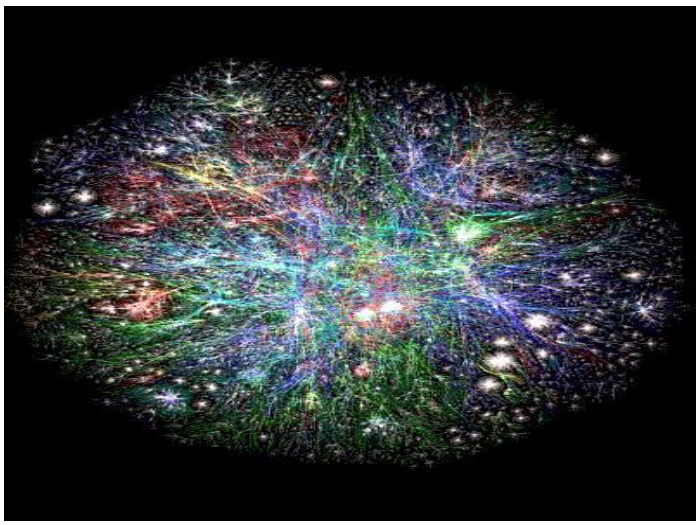

Figure 1.1 Internet map

In order to access the WWW, you need a browser. A browser is a program that allows you to launch the desired web site for example, Internet Explorer, Mozilla Firefox, Opera, Apple Safari, Google Chrome and Netscape. Every website has a uniform resource locator (URL) or simply known as a website address. To launch a particular website, you need to type the URL in the address box of your browser.

URL example:http://www.fiji.gov.fj

For a URL, http stands for Hypertext Transfer Protocol, the protocol used to accessing most web sites. WWW, the subdomain, is the network consisting of millions of internet sites that offer hypermedia resources.fiji.gov.fj is known as the domain name and .fj is known as the country code. For some URLs it called the top level domain code. **Table 1.1** below shows some commonly used top level domain codes.

Top Level Domain Code	Meaning
.com	Commercial
.gov	Government
.edu	Education
.net	Network
.mil	Military
.org	Organization

Table 1.1 Top level domain codes - meaning

Discovery Learning:

Identify, name and explain the different parts of some URLs including the directories and file names

Apart from the browser, you must also have access to the internet in order to utilize the web services. Internet access is usually granted by **Internet Service Providers** (ISP). Some common ISPs in Fiji are Connect Fiji, Unwired Fiji, Vodafone, Digicel, Kidanet by Fintel and USP through AARNET for USP students/staff only.

Review Exercise 1.1

True/False

a) Internet and WWW are same.

b) Multimedia can be used as hypermedia.

c) .com is an example of a top level domain code.

d) Browsers are programs that allow access to Web resources.

Completion

a) The domain code .org stands for _____.

b) A(n) _____ is the protocol used by browsers to access websites.

c) The _____ provide internet service to its subscribers.

Short Answer Questions

a) What is the difference between internet and WWW?

b) Explain the parts of an URL?

c) Give five examples of URLS?

d) What is hypermedia?

1.2 The Cyber-culture

Cyber - culture is a set of social expectations, etiquette, history and language used by a collection of people active on the World Wide Web. Just as the non-cyber world is separated into cliques and countries, the cyber world is separated into taxonomies and web spheres. The countries of the world are partially represented in cyberspace by the country domains, but more than ever people are less connected by language and locale and more by common interest. The importance of this cyber-culture to educational technology is that it is the ground upon which we should build our e-learning frameworks as it is rapidly becoming common ground for every connected person in the world.

Over the years cyber culture has been changing rapidly. This is partially because the browsers and website are capable of so much more rich media than in the past, and partially because the internet is becoming ubiquitous in mainstream offline society. Everyone in the real world has to have a connection to the cyber-world we have constructed.

Businesses can mark their success by the strength of their online brand. Some trends in use of the internet show that internet users have been decreasing in age. For those younger in age, there are social networking sites such as Facebook, MySpace, and Twitter, all of which serve to maintain connections with numerous friends. Users on these sites may post what they are doing – which all their friends are able to view – and comments on what other people are doing. It may be the world's largest gossip chain, and not a word has to be spoken for it to happen. Friends and siblings may not speak for over a year, yet they will still be able to tell what the other party had for breakfast that morning. Rumors can be started on networking sites, and they can sometimes ruin "real-life" friendships, if they are vicious enough. It seem silly to think that something typed on a computer screen can have such a far influence, but such is the power of the internet.

Figure 1.2 Social network

The effects of Cyber-culture

With the creation of the internet, the lifestyles of people around the globe have undergone a quick and drastic change. This new method of communication accounts for a large portion of how people interact, shop, learns, and transmits information. What used to take several months to cross from the Western Hemisphere to the Eastern Hemisphere now only takes a few seconds, courtesy of the power of electricity. While some may argue that the internet has only helped improve the cultures already existing, a valid argument may be made for the new internet subculture that has evolved. Americans in particular are notorious for spending more and more of their time in this new "cyber-culture".

1.3 Communication and Search Tools

Communication

There are several types of communication possible over the internet. The most common form of communication is *electronic mail* (e-mail). E-mail is the sending and receiving of electronic messages over the internet. There are two main types of e-mail. **Web-based e-mail** enables you to access your email account from any computer and usually store your e-mails on a Web server. Google's G-mail, MSN's Hotmail and Yahoo Mail are typical examples of these. The other type is the **client based e-mail**, which consists of an email program you install on your computer where the e-mail is downloaded and stored locally on your computer. In order to send and receive an email, you need an email account and internet access. The most commonly used client based e-mail programs for email are: Microsoft Outlook, Mozilla Thunderbird and Apple Mail.

A typical email message has three basic elements: **header**, **message** and **signature**. The **header** is typically made of three parts: Address, Subject and Attachment. *Address*: This is the section where you type the email address of the person you are sending the message to. *Subject*: gives a brief topic/heading as to what the message is about. *Attachment*: any other item that is not directly part of the message can be tagged together with the message, for example images, small videos, music and other files.

The **message** comes after the header, this is where you simply type the message you want to send the other party. The final part is the *signature* which is simple the additional information of the person sending the message. This signature is set once only and is tagged automatically with the message every time you compose a new email message. **Figure 1.3a** shows the three parts of a typical Microsoft Outlook email.

The second major form of communication these days is through *instant messaging* (IM) and *chat*. Both IM and chat offer live and direct communication however, IM is more sophisticated compared to chat.

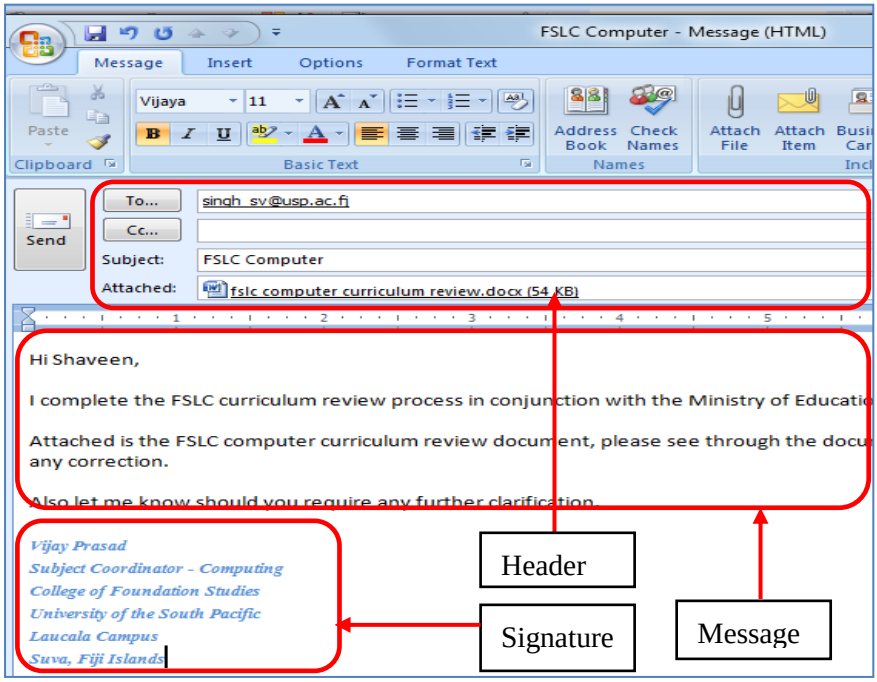

Figure 1.3a*MS Outlook email composition*

In addition to text messages, IM also allows file transfer, voice and video communication. Some common examples of IM are Skype, MSN live messenger and Yahoo messenger. You must note that at present there is no cross communication possible between different IMs. For example, a yahoo messenger user cannot communicate with a Skype user.

Chat on the other hand offers only text based messaging. However, this is far more favored and utilized simply because it costs less. Sending plain text messages over the internet is much cheaper than communicating via live video.

Search Tools

Search tools (also known as search engines) are programs that enable searching for relevant information on the WWW much easier. Most search engines present a default choice of *everything* or *web* category. This category displays relevant websites for the information being searched for.

However, the user can select a search category for images, videos, scholar articles, news, maps, shopping and many more for a more refined and direct search. The world's most widely used search engine today is Google. Some other commonly used search engines are Yahoo, MSN, Bing and WebCrawler. **Figure 1.3b** shows the Google search engine home page with the category tabs.

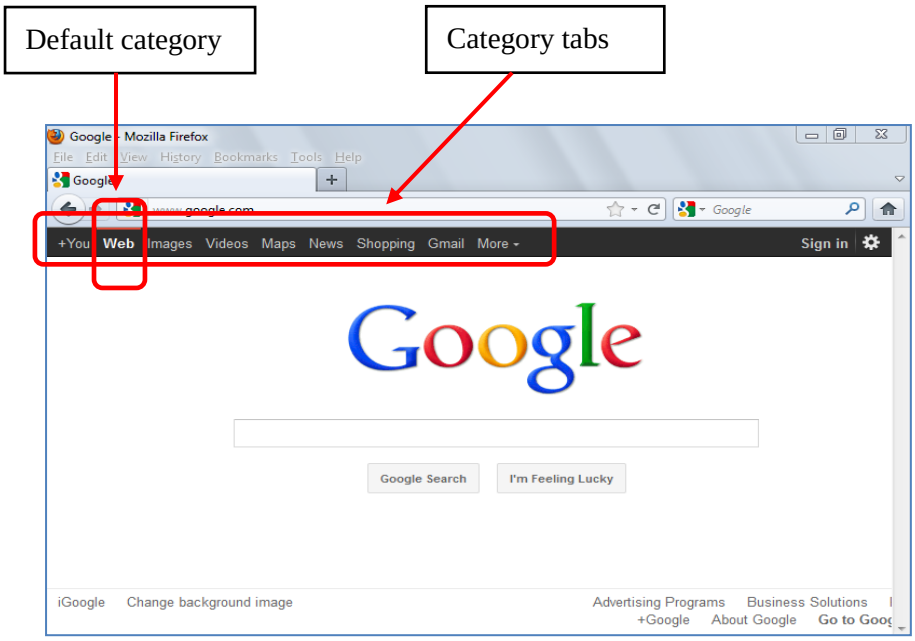

Figure 1.3b *Google search engine home page*

Discovery Learning:

What are the other forms of communication apart from e-mail, IM and chat? Describe them.

Review Exercise 1.3

True/False

a) The three parts of an e-mail are address, subject and attachment.

b) Google chrome is a search engine.

c) IM is more popular than chat.

Completion

a) Skype is an example of _____.

b) _____ allows people to communicate direct and live by sending plain text based messages.

c) The header of an email comprises of _____, _____ and _____.

Short Answer Questions

a) Compare and contrast IM and chat.

b) What is purpose of the signature in an email?

c) Describe the steps to set up a signature for your e-mail account.

1.4 Web Technologies

Web Utilities

Web Utilities are specialized programs that make using the Internet and Web easier and safer. Three web utilities discussed below are plug-ins, filters and file transfer.

Plug-ins are programs that can be loaded automatically as part of the browser thus enhancing the browsers capabilities in displaying information such as images and videos. A plug-in is the most important web utility.

Figure 1.4a lists some commonly used plug-ins.

Figure 1.4a

Filters are programs that simply allow blocking access to certain websites. Filters are usually useful for parents to use to block access to the unwanted sites that their children may be exposed to. Browsers such as Internet Explorer and Mozilla Firefox have built in filters that can be activated when necessary.

File transfer utilities such as *file transfer protocol* (FTP) enable the user to upload and download files. Uploading is the process of saving files from your local computer to the internet for example, saving your photo on the Facebook website. Downloading is the process of saving files such as music, video, images or any other information from the internet to your local computer. Most websites these days enable users to upload and download files, for example USP's Moodle website allows USP students to download lecture notes and tutorial questions/solutions as well as upload their assignments for marking.

A more convenient way of transferring files is through a *peer-to-peer* (P2P) networking (*explained in chapter 4*). These programs allow you to bypass any website to transfer files (can be very huge files like movies) directly to another person's computer. Limewire, Frostwire, Gnutella and Bit Torrent are examples of programs that enable P2P file sharing.

Social Networks

The fastest growing use of the internet today is *social networking*. This simply allows people all over the world to be connected to each other through the internet. Social networking also offers people gaming and file sharing possibilities. The most common application used is chat. Through chat people communicate direct and live with their friends, family and colleagues. Social networking can be

categorized as follows: reuniting sites, friend of a friend sites and common interest sites. Examples of free social networking sites are given in **Figure 1.4b**.

Discovery Learning:

Describe the three categories of social networking sites and give at least two examples of each category.

Blogs

A *blog* is a journal or newsletter that is updated frequently and intended for the general public. Blogs reflect their author's philosophical reflections, thoughts, ideas and opinions on social, political and *Information and Communications Technology* (ICT) related issues. Sometimes it is also used as a way for families or groups of friends to keep in touch. Automated tools allow users (even with little technical background) to easily create and maintain blogs. Blog sites like *www.blogger.com* and *www.blogcatalog.com*, offer such tools and free space for blogs which also includes uploading photos.

Discovery Learning:

Find some examples of blogging websites. Observe and write the common features amongst them.

Figure 1.4b*Free social networking sites*

Wikis

A *wiki* is a type of website that allows users to add, modify and delete contents. **Wikipedia**, the online encyclopedia is the best know example of this. The only problem with wikis is the quality and accuracy of the content added by users. Some open source software such as *Media Wiki* and *TWiki* are available for creating wikis.

Discovery Learning:

Select any topic of interest to you. Go to the Wikipedia website and search for that topic. See if you understand the explanations given and if not, try and add your own comments. Be sure not to delete any other comments.

Really Simple Syndication Feeds

Really Simple Syndication Feeds (RSS) provide a more convenient and fast way to distribute information. RSS pulls the latest updates from news, sports, entertainment, blogs, wikis and social network websites that you have subscribed to and brings these updates at one convenient place. Most people usually activate RSS feeds into their e-mails. Using *Outlook* to subscribe to an RSS Feed is quick and easy and does not involve a registration process or fee. After you subscribe to an RSS Feed, headlines will appear in your RSS folders. RSS items appear similar to e-mail messages in your *inbox*. When you see a headline that interests you, just click or open the item.

Podcasting

A *podcast* is an electronic audio file, such as an MP3/4 file uploaded on the Web for users to download to their mobile devices like *iPods, iPhones,* and *iPads*. It is like a personal radio station on the internet. iTunes and iPodder websites collect and store podcast for everyone to download. One example in Fiji is the Vodafone's hello tunes.

Discovery Learning:

Describe the difference between and iPod, iPhone and iPad.

Review Exercise 1.4

True/False

a) A plug in is a program that is independently activated to enhance the capabilities of a browser.

b) Filters are programs for blocking access to certain sites.

c) Uploading is the copying of files from the internet.

d) Blogs allow news updates to be fed into your email.

Completion

a) The three types of web utilities are _____, _____ and _____.

b) _____enables people to download music to their phones.

c) The most commonly used application in social networking is _____.

Short Answer Questions

a) What is the difference between a reuniting and common interest social network website? Give two examples of each.

b) Describe how RSS feeds work.

c) Give an example of podcasting.

Summary

1. Internet is the actual physical network that spans the entire globe. It is made up of computers, handheld devices, cables, switches, routers, satellitesand wireless devices. WWW is the multimedia interface to the resources available on the internet.
2. The most widely used communication tool over the internet is email. An email is made up of three parts, header, message and signature. The header has further three elements, address, subject and attachment.
3. Search engines allow people to search for their desired information on the WWW easily. Different categories allow search to be more refined and subject focused.
4. Web utilities allow safe and convenient ways to surf the net.
5. Social networks connect people, friends and colleagues all over the world.
6. Blogging allow people to express their opinions on certain social, political, and ICT related issues.

7. Wikis allow people to add, delete and modify contents posted on a website.
8. Podcasting enables people to download music to their mobile devices.

Key Terms

blogs	plug-in
chat	podcasting
e-mail	RSS
ergonomics	search engine
filters	wikis
instant messaging	WWW
internet	

Review Questions – Multiple Choice

1) Rules for exchanging data between computers is
   a. Prototype.
   b. Procedures.
   c. Protocols.
   d. Programs.

2) The fastest growing activity on the internet is
   a. Blogging.
   b. E-mailing.
   c. E-commerce.
   d. Social networking.

3) The extensions, .com, .edu, .mil, .net and .gov all refer to
    a. Protocols.
    b. Domain codes.
    c. Domain names.
    d. Sub-domain names.

4) Highlighted text on a web that connects other web sites or places within the same website is called a
    a. hyperlink.
    b. plug-in.
    c. filter.
    d. blog.

Review Questions – Short Answers

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1) Discuss the advantages and disadvantages of internet.
2) Briefly describe the difference between the internet and the WWW.
3) What is social networking? Give three examples.
4) What is the difference between blogs and wikis?
5) Explain how plug-ins works? Give four examples.

Additional Readings

O'Leary, T. J, O'Leary, L. I. *Computing Essentials 2012 Complete Edition*. McGraw Hill, New York, 2011.

Bidgoli, H. *MIS2*. Course Technology, Cengage Learning, Boston USA, 2010.

Chapter 2 

Careers for Computing Professionals

After completing this chapter, you will be able to:

1. Distinguish between different career paths in computing.

Discovery Learning: Discuss the latest computer careers in Fiji today.

2.0 Introduction

Jobs in computing and information technology are in high demand and offer high job satisfaction. Students with a degree in computer science are qualified to pursue a career in a wide variety of computing careers. Careers are possible in various computer-related fields, including computer science, computer engineering and information technology. Job positions range from computer programmer to computer systems analyst and computer hardware engineer, among many others. Some of the career opportunities in computing are as follows:

2.1 Careers in Computing

Computer programmers write, revise, test, debug, and maintain the programs that instruct computers how to carry out certain tasks. Programmers write these instructions in coding languages like Java or C++, which computers can then follow. The job of a programmer may involve a great deal of coding to very little coding in the case of some management positions.

Database Administrators develop, implement, manage and maintain databases that enable you to find a friend's profile on your favorite social media network or find an article in an online library. These professionals define all of the parameters needed to store, retrieve, and delete data. Database administrators monitor, test, troubleshoot, and enhance databases as they grow and change.

Helpdesk support professionals help end-users or customers by diagnosing and assisting with technical problems. These professionals communicate with user's in-person, via phone or electronically to address technical hardware and software issues.

IT operations managers keep the gears of an organization's technical operations running smoothly. They oversee day-to-day processes including performance management, monitoring and evaluation, measuring success, IT purchasing, compliance with policies, infrastructure improvements, and resource maintenance.

IT training professionals ensure that employees and end-users remain technologically savvy through the design, delivery and assessment of training programs. Training topics may include desktop applications, internet browsers, or company specific applications. They might also cover IT professional skills such as project management, security protocols, or programming languages.

Network engineers care for an organization's technological "nervous system" by ensuring that communication networks operate smoothly and efficiently for users and customers. They install, maintain, and support IT systems such as T1 lines, routers and firewalls. These professionals may be part of the IT department or be brought in as part of an IT consultancy.

Project managers strive to keep the projects that turn ideas into reality on time, on task and on budget. They marry technical knowledge with supervisory skills to lead a team and ensure that projects are completed efficiently and effectively.

Sales analysts connect clients and customers with technological products and services to meet their business needs. They may demonstrate products for customers to help them understand their features. Sales analysts also negotiate sales and follow-up with customers after the sale to ensure satisfaction, identify any problems, maximize usage, and recommend training.

Security analysts safeguard and protect an organization's technology and systems from intrusion or harm. They monitor current systems, assess potential threats, and put measures in place to ensure that files are neither deliberately or accidentally changed, damaged, deleted or even stolen.

Software designers create software for an organization or its external clients and customers. They often see a project from inception to completion, taking into consideration the needs of clients or stakeholders. Software designers assess the requirements of the software, and ensure that they are met. They may or may not perform the actual coding for the project.

Software developers research, design, develop, and test software and systems found in technologies ranging from automobiles, to gaming systems, to life saving medical equipment. A software developer can be involved in many different aspects of a project ranging from coding, to design, to project management.

Software is all around us. It is used in smart phones, GPS systems, and digital cameras. *Software engineers* are responsible for designing, testing, and evaluating the software that we use every day.

Web/internet engineers develop web pages and interfaces for an organization's external or internal websites. Responsibilities may include building web sites, internet applications, social media networks, and e-commerce applications through code. They may also include configuring web servers and network security, server-side or client-side scripting, web design and content development.

Chapter 3

Computers in Society

"*There are several reasons why computers have become so important. They operate at extremely high speeds, have the ability to store and retrieve vast quantities of information, and can make decisions based on the results of previous operations. With just these primitive functions, a generation of programmers has created a body of software that can control a missile, intercept a message, and predict the results of an election, or automates a factory.*"

David Brandon and Michael Harrison, the Technology War

After completing this chapter, you will be able to:

1. Investigate and explain the most significant concerns for effective implementation of computer technology.
2. Discuss the privacy issues of accuracy, property and access.
3. Describe the security threats posed by computer criminals.
4. Investigate and explain computer crimes including creation of malicious program.
5. Identify ways to protect computer security.
6. Define ethics and explain the major laws on privacy.

3.0 Introduction

The dawn of the new computer era glows before us with new innovative ideas, ways of thinking and living. The amount of information and technology is said to be changing every 6 months from Mobile phones, I-pad, and computers (notebooks to desktop PC). The only way to keep up with these is to understand, how technology works and the ability to control them so that human interaction would be able to accept and live with the changes.

3.1 Computerization of Society

The *computerization of society* refers broadly to the widespread use of computers, which has led to the restructuring of many functions in society. The computerization of society is the result of **economic** and **technological trends.** In *economic trend* the computer can store, process and communicate information. It has helped to enhance the value of information and add value to products and services. For example, the clients' data in an insurance company can process and create profiles which enable the company to match its services better with its clients. *Technological trend* on the other hand is the development of microelectronic technology which has led to changes in both the nature of the products produced and the process by which the products are designed and manufactured.

In an office, the computer can automate the tasks of typing, editing, copying, filing, preparing reports, sending messages, preparing budgets and accounting work. Table 3.1 explains the positive and negative impacts of computerization.

Discovery Learning:

What are some important factors to consider when designing an automated office?

Impacts of Computerization	
Positive Impacts	***Negative Impacts***
New jobs and job efficiency	Reduction in social interaction at work
New products and services	Increased stress in learning new computer skills
Increase in quality of products	Exposure to unwanted activities
Overall increase in the quality of living	Health Issues

Table 3.1*Impacts of computerization*

Enhancing efficiency across multiple sections of the society

The *management productivity* can be improved by the use of computers because managers/decision makers can receive timely, sufficient and meaningful information which enable them to make informed decisions at the right time. An **information society** is one in which most of the population is involved in gathering, processing and communicating information rather than physically producing goods. Some information workers are *clerks, lawyers, doctors, architects, educators* and *newsmen*. The computer, with its capability to store, organize, retrieve and communicate large amounts of information in many different ways allow organizations to consider information as a strategic resource that adds value to the goods or services their company offers.

Transportation – Most road users nowadays have used computers to monitor the use of fluid levels, temperatures and electrical systems. Computers are also employed to determine road network connectivity from point A to point B using Global Positioning System (GPS), especially for locating supermarkets, building locations and tracks vehicles for long distance travelling, for example, the Fiji Water delivery trucks.

An important part is the air control traffic systems, where computers are used to control the flow of traffic between airplanes which need precise and accurate information of landing and takeoff.

Figure 3.1a *GPS device*

Paper Work – The extensive use of computer systems in most public and private companies or even schools, and universities, eventually reduce the amount of paper work. In the past most business organization preferred paper work, however, not realizing that it was making the administration work more tedious and error prone. Computer makes their work easier, faster and more effective than the manual system.

Banking – Computers speed up record keeping and allow banks to offer the same day services and even do it yourself over the phone banking for example ANZ, BSP, Westpac and also **internet banking systems** as shown in Figure 3.1b. In addition to these computers are involved in most transactions (money) as there is a better chance of detecting illegal money laundering via internet on the use of credit/debit cards.

Education - It has been proven that with the use of computers, learning becomes more successful which is why numerous forms of teaching methods have been introduced involving the use of computers. It enhances the student's knowledge at a faster pace compared to the traditional methods of teaching and learning. Figure 3.1c shows USP's e-learning management system – Moodle.

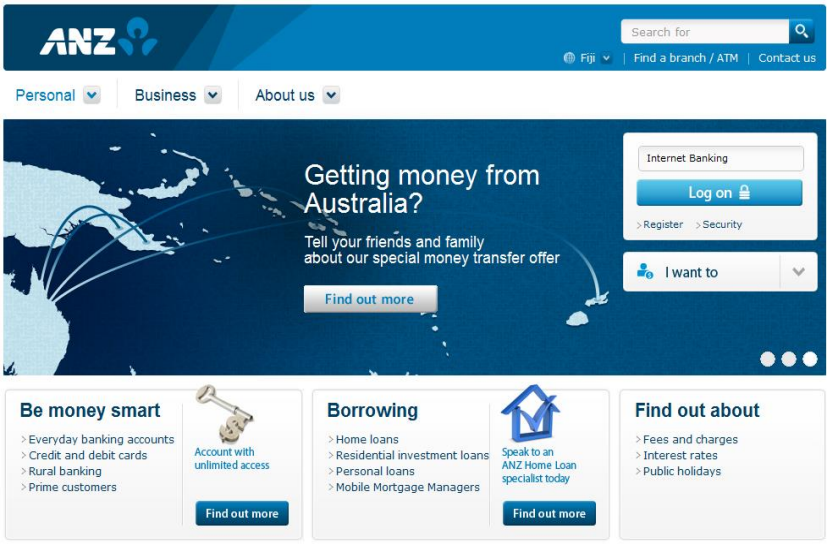


Figure 3.1b *ANZ Internet banking home page for Fiji customers*

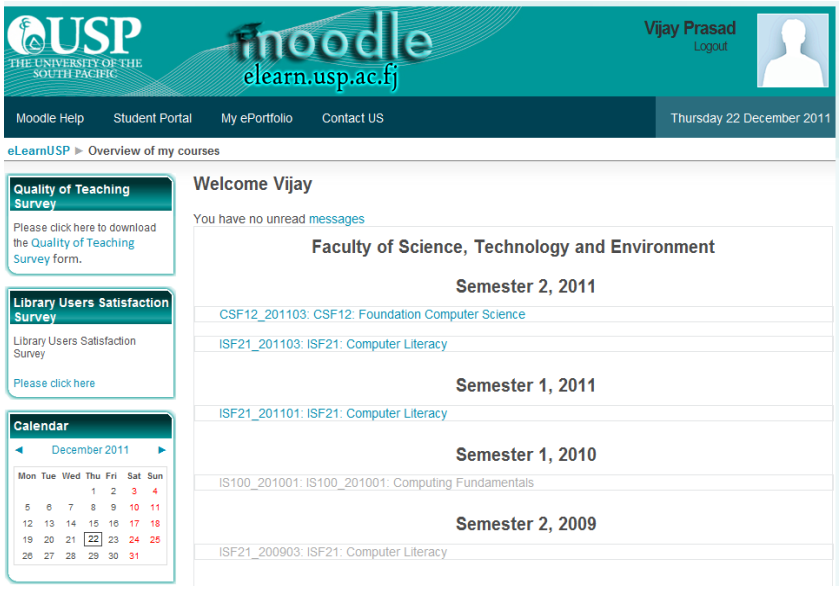


Figure 3.1c*USP's e-learning management system*

Government - A government provides society with directions by making and administering policies. To provide citizens with up-to-date information, most government officers have websites. For example, to access the government website in Fiji, you will be able to get information from: http://www.fiji.gov.fj. In addition to providing information via computers, employees of government agencies use computers as part of their daily work routine. In Fiji, ITC services enable officers to access all government ministries' emails and websites as well. Computer systems are used extensively by the disciplinary forces, for example, the Army, Police and Navy. Furthermore, computers will need to be programmed

more appropriately so that they are precise and accurate in order to provide the right information to support their investigations and evidence they provide.

Figure 3.1d *ITC website e-Government portal*

Law Enforcement- Law enforcement includes computer modeling of DNA, which has the ability to match traces of any form of criminal activities such as murder - (blood samples). For example, movie series such as CSI, MIAMI and NYPD have demonstrated the capabilities of computers in determining the desired outcome of most crimes committed.

Medicine & Health Care - Nearly every area of the medical field uses computers. In most hospitals, doctors use computers to assist them in diagnosing diseases of any kind. This type of computer is called the **Expert System**, which is often used in most specific field of medicine, for example, in conducting heart surgery, eye check and in detecting various forms of diseases. Furthermore, computers are being used widely in hospitals to assist medical staff in managing patients' records, doctors, nurses, prescription [medicine] records as well as making, and scheduling appointments of patients.

Review Exercise 3.1

True or False

a) Management productivity can be improved without the use of computer.

Fill in the Blank

a) The computerization of society is the result of _____ and_____**.**

b) Computers which are used in hospitals to diagnose diseases of any kind are called _____.

c) _____ is one in which most of the population is involved in gathering, processing and communicating information rather than physically producing goods.

3.2 Privacy of Information

Information has become an invaluable asset for both individuals and organizations. As you become comfortable working with technology, you will naturally explore methods of gathering, storing and exchanging data. With this power in the form of knowledge, there is also the potential tendency for abuse. When used with malice or neglect, computer technology can become a tool for committing crimes or infringing upon your individual rights or privacy. You probably think first of the law. Of course that is right, but technology is moving so fast that it is difficult for our legal system to keep up with it. The essential element which guides how computers are used today is **ethics**. *Ethics* are standards of moral conduct. **Computer Ethics** are guidelines for the morally acceptable use of computers in our society or the standard behavior regarding the use of computers for individuals and organizations.

Ethical treatment is critically important to us all and we are all entitled to ethical treatment. This includes the right to keep personal information, such as credit ratings and medical histories, from getting into unauthorized hands.

There are four primary computer ethical issues:

- *Privacy* concerns the collection and use of data about individuals.
- *Accuracy* relates to the responsibility of those who collect data to ensure that the data is correct and up to date.
- *Property* relates to who owns data and rights to software.
- *Access* relates to responsibility of those who have data to control who is able to use that data.

Some ethical questions surrounding computers
Is it right for someone who buys a program to copy it for a friend?
Is it fair to tap into someone else's computer data files?
Should computer operators regard all data they process as completely confidential?
Does a company owe a worker who has been replaced by a computer or any consideration other than that prescribed by labour law or contract?

Table 3.2 *Ethical questions*

Information about individuals that may be kept in data files or databases may include email & residential addresses, telephone numbers, financial status, health, education and work experience, criminal record, credit history and driving license record. Since that is the case, these data in a database may then be misused through the inaccuracy of the data stored because of inadequate updating, for example, a bank that does not update the accounts of its depositors can ruin the financial status of its depositors.

Another way of misusing data in a database is through the indiscriminate use of data for other purposes, for example, a credit card company should not release credit histories of a prospective client to others without the permission of the client. Information in a database can be stolen by electronically tapping into the computer system and reading the data, bribing employees to copy the data, or physically breaking into the computer center and stealing the storage devices. A database administrator can protect a database against unauthorized access through the screening and monitoring of the people handling the data, enabling passwords, encryption devices, and special log-in routines and appropriate physical protection.

Figure 3.2a *Ethics*

Discovery Learning:

Give examples of ethical breaches in Fiji in terms of computer usage.

Some of the major concerns regarding privacy are the *spreading of information without personal consent*. How would you feel if your name and your taste in movies were made available nationwide? How would you feel if someone obtained a driver's license and credit cards in your name? What if that person then used your identity to buy clothes, cars and a house? This is called **identity theft**. *Identity theft* is the illegal assumption of someone's identity for the purpose of economic gain.

Spreading of inaccurate information occur due to mistakes in recording which can quickly spread to other files. Cases of *mistaken identity* can occur from these instances, where the electronic profile of one person is switched with another.

When visiting a Web site, your activity is monitored, that is, your browser stores critical information onto the hard disk, usually without your permission or knowledge. For example, your browser creates a *history file* that includes the location of sites visited by your browser.

Another way your Web activity is monitored is by *cookies* or specialized programs that are deposited on your hard disk from Web sites you have visited. *Spyware* is used to describe a wide range of programs that are designed to secretly record and report an individual's activities on the Internet.

Discovery Learning:

Give some examples of spyware and its possible characteristics.

Revision Exercise 3.2

Fill in the Blank

a) The process of converting readable data into unreadable form is known as _____.

b) Characters to prevent unauthorized access are called_____.

c) _____monitors which sites you visit on the internet.

Short Answer

a) Describe the sort of information about individuals whose profiles are kept in databases.

b) Briefly explain how outsiders can steal information in a database.

c) Outline how a database owner can protect a database against unauthorized access.

d) Explain the government's stand in protecting the misuse of information in a database.

3.3 Computer Criminals

Computer crime involves the use of computer and software for illegal purpose. Computer crime takes many forms, from unintentional disruption to vengeful acts to fraud. A computer crime is an illegal action in which the person responsible uses special knowledge of computer technology for illegal purposes.

Typically, computer criminals are either employees, outside users, hackers, crackers, carders, organized crime members, or terrorists.

The largest category of computer criminals consists of those with the easiest access to computer namely the *Employees*. Sometimes the employee is simply trying to steal something from the employer whether it is the equipment, software, electronic funds, proprietary information, or computer time. Sometimes the employee may be acting out of resentment and is trying to "get back" at the company. Not only employees but also some suppliers or clients may have access to a company's computer system known as the *Outside Users*. For example bank customers who use an automatic teller machine. Like employees, these authorized users may obtain confidential passwords or find other ways of committing computer crimes.

In most organisations, people who committed cyber-crime are classified as Hackers and Crackers. For instance people think of these two groups as being the same, but they are not. *Hackers* are people who gain unauthorized access to a computer system for the fun and challenge of it or are people who create or improve programs and share those programs with fellow hackers. Typically, they are not criminals. *Crackers* do the same thing create and share programs designed to gain unauthorized access to computer systems or disrupt networks their motives are malicious and can be very destructive and costly. Typically, they are criminals. *Carders* are criminals who specialize in stealing, trading, and using stolen credit cards over the internet. Some carders use sophisticated electronic devices to copy data from your credit or debit card including account numbers and PINs.

Organized crime has discovered that computers can be used just like legitimate business people use them, but for illegal purposes. For example, computers are useful for keeping track of stolen goods or illegal gambling debts. In addition, counterfeiters and forgers use microcomputers and printer to produce sophisticated-looking documents such as checks and driver's licenses and currency.

Computer fraud is other type of crime which is committed by exploiting loopholes in a computer system, or by employing inside knowledge about how a computer system works. Most computer fraud is committed by insiders such as programmers who can attempt to escape detection by covering up their tracks before the fraud is noticed.

Terrorists: knowledgeable terrorist groups and hostile governments could potentially crash satellites and wage economic warfare by disrupting navigation and communication systems.

Discovery Learning:

Give some reasons why people engage in computer based crimes.

Three Reasons for the increase in Computer Crime

- Many more people now know how to operate the computer.
- Many computers are now linked together through networks.
- The easy access to large databases through microcomputers.

Four Reasons why it is difficult to detect Computer Crime

- The crime is complex and is not easily discovered.
- It is difficult to trace the guilty party once the crime is discovered, because of the difficulty in finding evidence.
- There are usually no witnesses although the crime can be taking place in a room full of people.
- Law enforcement people are usually ignorant and unaware of the complexity of computer technology and as such are unable to guard against misuse of the computer.

Review Exercise 3.3

Fill in the Blank

a) People who committed cybercrime are classified as _____ and _____.

b) The use of special hardware and software techniques to prevent the illegal copying of software are known as _____

c) To make copies of a software package for use at one site it needs to have a _____.

Short Answer

a) Define computer crime. Give two examples of computer crime.

b) The stealing of designs and trade secrets is called_____.

c) Explain what is meant by site licensing

3.4 The Computer Crime

Computer Crime
Computer crime can take various forms including the creation of malicious programs, denial of service attacks, internet scams, thief, and data manipulation.

Malicious programs Crackers are notorious for creating and distributing malicious programs. These programs are called **malware**, which is short for **mal**icious soft**ware.** They are specifically designed to damage or disrupt a computer system. The three most common types of malware are viruses, worms and Trojan horses.

A **computer virus** is a damaging computer program that affects, or *infects*, your computer negatively by changing the way the computer works without your permission. *Viruses* are programs that migrate through networks of networks (internet) via operating systems, most of these viruses attached to different files, programs and websites. Once a virus is in your computer, it can spread throughout and may damage your files and operating system. The rise in use of networks, for example, the internet and emails has increased the spread of computer viruses. Viruses are activated on your computer in three basic ways as given in table 3.3:

Ways in which viruses can be activated on your computer
Opening an infected file
Running an infected program
Using infected flash drives to transfer files to and from your computer.

Table 3.3*Virus activation*

Creating and knowingly spreading a virus is a very serious crime and a federal offence punishable under the **Computer Fraud and Abuse Act.**

Unfortunately, new computer viruses are appearing all the time. The best way to stay current is through services that keep track of viruses on a daily basis.

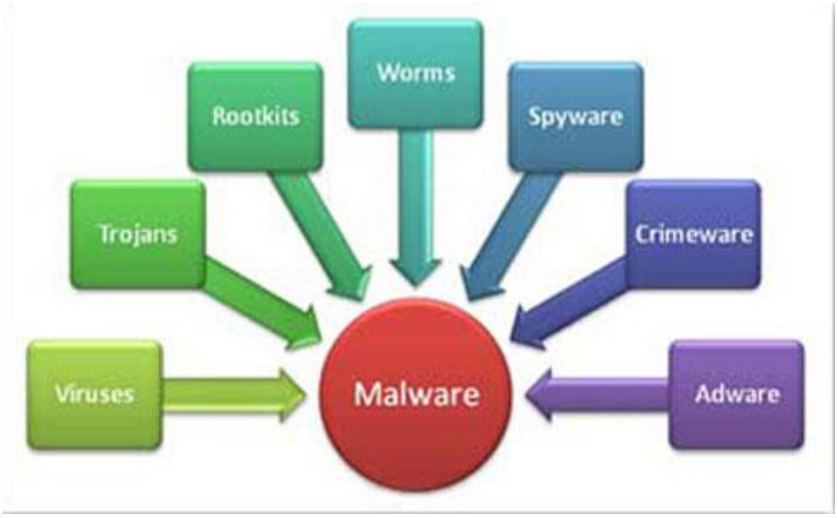


Figure 3.4a *Types of Computer Viruses*

Worm is a malicious program or *malware* that copies itself repeatedly in memory or on a disk drive until no memory or disk space remains. When no memory or disk space remains, the computer stops working. Some worm programs even copy themselves to other computers on a network. Worms are special type of virus that does not attach itself to programs and databases. Rather it fills a computer system with self-replicating information, clogging the system so that its operation are slowed or stopped. A recent worm traveled across the world within hours, stopping tens of thousands of computers along its way. Internet worms also can be carriers of more traditional viruses. Once the traditional virus has been deposited by a worm onto an unsuspecting computer system, the virus will either activate immediately or lie dormant until some future time. Viruses and worms typically find their way into microcomputers through e-mail attachments and programs downloaded from the internet.

Trojan horse is a wicked program under the guise of a legitimate program on a bulletin board system. When the program is downloaded for use it does damage to the hard disk, data or programs that are already in the computer. Trojan horses are normally transferred as email attachments.

Figure 3.4b *Virus & Endpoint Protection*

Zombies are computers infected by a virus, worm, or Trojan horse that allows them to be remotely controlled for malicious purposes. A collection of zombie's computers is known as a **botnet**, or **robot network**. Botnets harness the combine power of many zombies for malicious activities like password cracking or sending junk e-mail. Because they are formed by many computers distributed across the internet, botnets are hard to shut down even after they are detected. Unfortunately for individual computer owners, it also can be difficult to detect when a personal computer has been comprised.

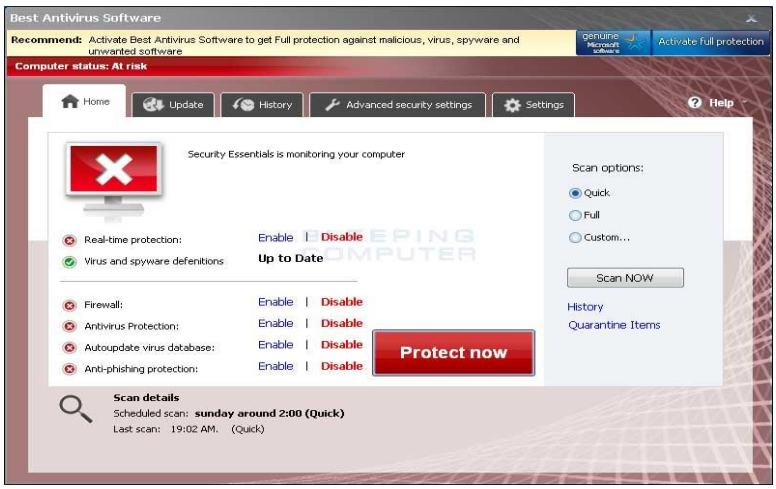


Figure 3.4c *Antivirus Software*

A denial of services (DoS) attack attempts to slow down or stop a computer system or network by flooding a computer or network with requests for information and data. The targets of these attacks are usually internet service providers (ISPs) and specific Web sites.

Internet scams: A **scam** is a fraudulent or deceptive act or operation designed to trick individuals into providing personal information or spending their time and money for little or no return. An **internet scam** is simply a scam using the internet. Internet scams are becoming a serious problem and have created financial and legal problems for thousands of people. Almost all of the scams are initiated by a mass mailing to unsuspecting individuals. A technique often employed by scammers is **phishing**. Phishing attempts to trick internet users into thinking a fake but official looking Web site or email is legitimate. Phishing has grown in sophistication, replicating entire Web sites like PayPal to try to lure users into divulging their financial information.

Social networking risks: Social networking is designed to open sharing of information among individuals that share a common interest. Unfortunately, this openness can put individuals using social networking sites at risk. Some have lost their jobs after posting unflattering remarks about their supervisor or after discussing their dislike of their current job. While others can send their personal information that can be used by others to steal personal identities and commit other types of crime.

Cyber-bullying*:* A fairly recent and all too-common phenomenon, **cyber-bullying** is the use of the internet, cell phones, or other devices to send or post content intended to hurt or embarrass another person. Although not always a crime, it can lead to criminal prosecution. cyber-bulling includes sending repeated unwanted e-mails to an individual who has stated that he or she wants no further contact with the sender, ganging up on victims in electronic forums, posting false statements designed to injure the

reputation of another, maliciously disclosing personal data about a person that could lead to harm to that person and sending any type of communication that is threatening or harassing. Never participate in cyber-bulling, and discourage others from participating in this dangerous and hateful activity.

Rogue Wi-Fi Hotspots*:* Free Wi-Fi network are available almost everywhere from libraries to fast food restaurants and coffee shops. **Rogue Wi-Fi hotspots** imitate these free networks. These rogue networks operate close to the legitimate free hotspots and typically provide stronger signals that many users unsuspectingly connect to. Once connected, the rogue networks capture any and all information sent by the users to legitimate sites including user names and passwords.

Theft*:* Theft can take many forms – of hardware, of software, of data, of computer time. Thieves steal equipment and programs, of course, but there are also white collar crimes. These crimes include the theft of data in the form of confidential information such as preferred-client lists. Another common crime is the use (theft) of a company's computer time by an employee to run another business.

Data manipulation: Finding entry into someone's computer network and leaving a prankster's message may seem like fun, which is why hackers do it. It is still against the law. Moreover, even if the manipulation seems harmless, it may cause a great deal of anxiety and wasted time among network users.

Other Hazards

There are plenty of other hazards to computer systems and data besides criminals. They include the following:

Natural hazards: Natural forces include fires, floods, wind, hurricanes, tornadoes, and earthquakes. Even home computer users should store backup disks of program s and data in safe locations in case of fire and storm damage.

Civil strife and terrorism: Wars, riots, and terrorist activities are real risks in all parts of the world. Even people in developed countries must be mindful of these acts.

Technological failures: Hardware and software don't always do what they are supposed to do. For instance, too little electricity, caused by a brownout or blackout, may cause the loss of data in primary storage. Too much electricity, as when lighting or some other electrical disturbance affects a power line, may cause a **voltage surge** or **spike**. This excess of electricity may destroy chips or other electronic components of a computer.

Human errors: Human mistakes are inevitable. Data entry errors are probably the most commonplace and can lead to mistake identity. Programmer errors also occur frequently. Some mistakes may result from fault design, as when a software manufacturer makes a deletion command closely resembling another command. Some errors may be the result of sloppy procedures. One such example occurs when office worker saves important documents under file names that are not descriptive and not recognizable by others.

Discovery Learning:

What can you do to protect the security of your microcomputer system?

Revision Exercise 3.4

Fill in the Blank

a) An_____ protects a computer against viruses by identifying and removing any viruses found in memory.

b) _____ computer virus to ever hit the Internet.

c) The most difficult kind of bug to detect and the most difficult to stop are called _____.

Short Answer

a) Define a computer virus.

b) Briefly outline how a virus spreads.

c) Explain a harmful action of viruses.

3.5 Measures to Protect Computer Security

Computer security is very important because there are a number of ways computer systems and data can be compromised. It's concerned with protecting information, hardware and software from unauthorized use as well as from damage, intrusions, sabotage, and natural disasters. Considering the numerous ways in which computer systems and data can be compromised, we can see why security is a growing field. Some of the principal measures to protect computer security are *encryption*, *restricting access*, *anticipating disasters*, and *backing up* data.

Encryption

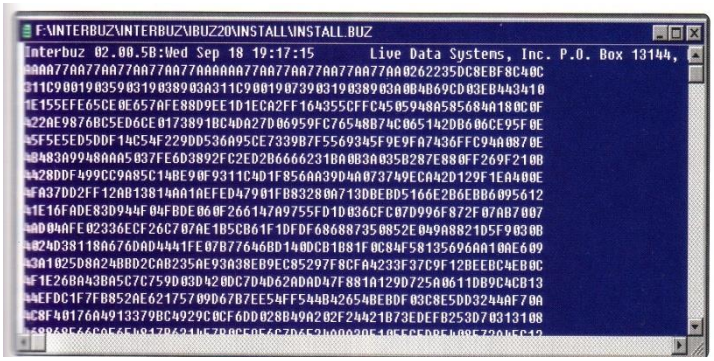


Figure 3.5a*Encrypting Message*

Whenever information is sent over a network, there is always a possibility that this information will be accessed without authorization. The longer the distance travelled, the higher the security risk. One way to protect sensitive data and information is to encrypt it. *Encryption* is the process of converting readable data into unreadable characters. To read the data, the recipient must decrypt it, or decipher it into readable form. Some special log-in routines are voice and signature verification systems. A voice verification system compares a person's live speech with their stored voice pattern whereas signature verification system recognizes the shape of your handwritten signature, as well as measuring the pressure exerted and the motion used to write the signature.

Some common uses for encryption include:

*E-mail encryption***:** Protects e-mail messages as they move across the Internet. One of the most widely used personal e-mail encryption programs is Pretty Good Privacy.

*File encryption***:** Protects sensitive files by encrypting them before they are stored on a hard drive. Files can be encrypted individually, or specialized software can be used to encrypt all files automatically each time they are saved to a certain hard drive location.

*Web site encryption***:** secures web transactions, especially financial transactions. Web pages that accept passwords or confidential information like credit card number is often encrypted.

Virtual Private Network: Virtual private networks (VPNs) encrypt connections between company networks and remote users such as workers connection from home. This connection creates a secure virtual connection to a company LAN across the internet. Wireless network encryption: Restricts access to authorized users on wireless networks. WEP (Wired Equivalent Privacy) is one of the best known wireless encryption protocols. it is being replaced by more secure encryption protocols such as WPA and WPA2 (Wi-Fi Protected Access).

Restricting Access

A *password* is a unique combination of characters, such as letters of the alphabet or numbers which identifies and allows access to certain computer resources. Longer and mixed (alphabets plus numbers) passwords provide greater security than shorter ones. A *username*, or user ID, is a unique combination of characters, such as letters of the alphabet or numbers that identifies a specific user.

PASSWORD PROTECTION

Number of Characters	Possible Combinations	AVERAGE TIME TO DISCOVER	
		Human	Computer
1	36	3 minutes	.000018 second
2	1,300	2 hours	.00065 second
3	47,000	3 days	.02 second
4	1,700,000	3 months	1 second
5	60,000,000	10 years	30 seconds
10	3,700,000,000,000,000	580 million years	59 years

- *Possible characters include the letters A–Z and numbers 0–9*
- *Human discovery assumes 1 try every 10 seconds*
- *Computer discovery assumes one million tries per second*
- *Average time assumes the password would be discovered in approximately half the time it would take to try all possible combinations*

Figure 3.5b *password protection*

A *possessed object* is any item that you carry to gain access to a computer facility. An example of a possessed object is a smart card like an ATM card. To use a possessed object, you will need a *personal Identification number* (*PIN*), which is a numeric password, either assigned by a company or selected by the user.

Figure 3.6c *Card Access security system*

Biometric security devices and systems include fingerprint scanners, face recognition systems, voice verification systems and iris recognition systems. The Biometric devices are becoming more popular because they are a nearly perfect method of identification and authentication. With a *Callback system*, a user connects to a computer only after the computer calls that user back at a previously established telephone number.

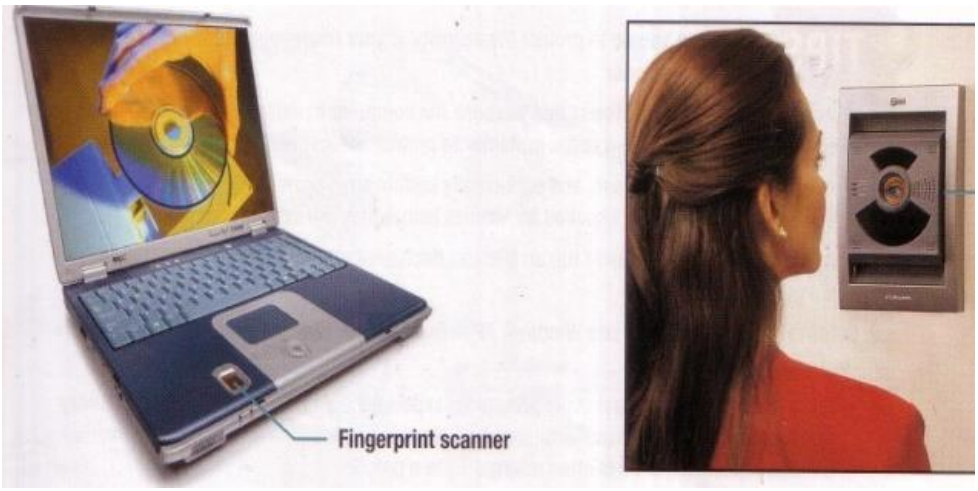


Figure 3.5d*biometric devices – Fingerprint scanner (left) & retinal scan (right)*

A **firewall** is a security system consisting of hardware or software that prevents unauthorized access to data, information, and storage media on a network. Most companies use firewalls to deny network access to outsiders and to restrict employees' access to sensitive data such as payroll or personnel records.

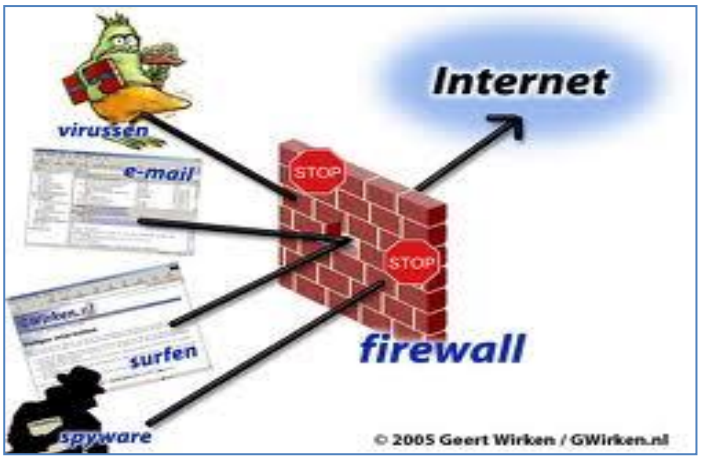


Figure 3.5e*Firewall*

Anticipating Disasters

Companies and individuals should prepare themselves for disasters. *Physical security* involves protecting hardware from possible human and natural disasters. This includes keeping hardware behind locked doors, locking equipment to a desk or floor etc. *Data security* involves protecting software and data from unauthorized tampering or damage. Most large organization have a **disaster recovery plan** describing ways to continue operating until normal computer operations can be restored.

Preventing Data Loss

Equipment can be replaced. A company's data however may be irreplaceable therefore it is a very important procedure to back-up data, that is, to make frequent back-ups or copies of data and to store them in safe remote places.

The harmless intrusion of a hacker into an organizations computer system can help the organization by identifying the weaknesses or loopholes in its security system.

Copyright and Digital Rights Management

Copyright is the legal concept that gives content creators the right to control use and distribution of their work. Materials that can be copyrighted include paintings, books, music, films, and even video games. Some users choose to make unauthorized copies of digital media, which violates copyright. For example, making an unauthorized copy of a digital music file for a friend might be a copyright violation.

Software piracy is the unauthorized copying and distribution of software. The **Digital Millennium Copyright Act** establishes the right of a program owner to make a backup copy of any program. The act also establishes that none of these copies may be legally resold or given away. This may come as a surprise to those who copy software from a friend, but that is a law. It is also illegal to download copyright-protected music and videos from the internet. To prevent copyright violation, corporations often use **digital rights management (DRM).** DRM encompasses various technologies that control access to electronic media and files. Typically, DRM is used to control the number of devices that can access a given file as well as limit the kinds of devices that can access a file.

Plagiarism

Another ethical issue is plagiarism, which means representing some other person's work and ideas as your own without giving credit to the original source. Although plagiarism was a problem long before the invention of computers, computer technology has made plagiarism easier. For example, simply cutting and pasting content from a web page into a report or paper may seem tempting to an overworked student or employee. Correspondingly, computer technology has made it easier than ever to recognize and catch plagiarists. For example, services such as Turnitin are dedicated to preventing internet plagiarism. The service will examine the content of a paper and compare it to a wide range of known public electronic documents including Web pages content. In this way, Turnitin can identify undocumented papers.

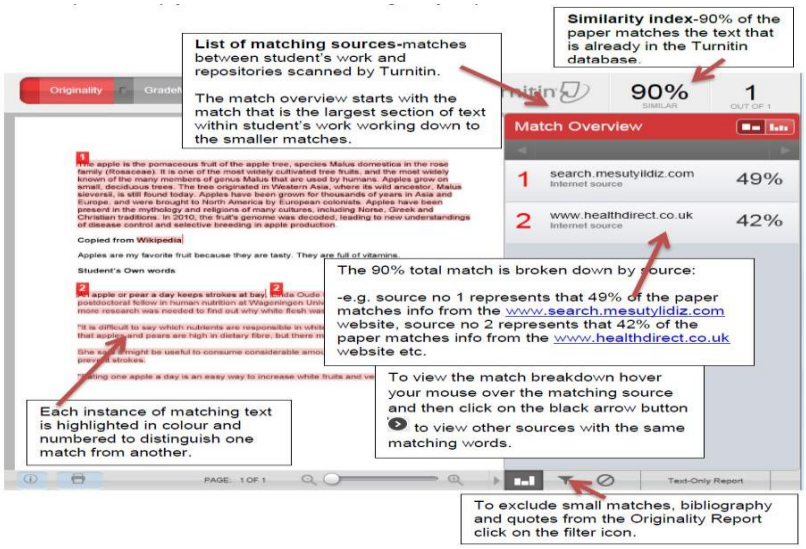


Figure 3.5a *Using Turnitin software.*

Revision Exercise 3.5

Fill in the blank

a) ____ is an example of a biometric security device .

b) Most companies use _____to deny network access to outsiders.

c) _____ are more secured than the _____.

Short Answer

a) List the security measures that can be used to prevent computer crimes.

b) Explain how an organization can benefit from a hacker's harmless intrusion into a computer system.

c) What do you understand by the term encryption process?

d) In your own words, explain "username & password"

Chapter 4 

Communications and Networks

"The fantastic advances in the field of electronic communication constitute a greater danger to the privacy of the individual."

— Earl Warren

After completing this chapter, you will be able to:

1. Explain data communication and connectivity.
2. Describe physical and wireless communication channels.
3. Discuss connection devices and services including dial-up, DSL, cable, satellite and cellular.
4. Describe data transmission factors, including protocols and bandwidth.
5. Discuss transmission methods and modes of transmitting data.
6. Describe the common network devices.
7. Explain different types of network.
8. Discuss network architecture including topologies and strategies.
9. Describe the characteristics and purpose of common network environments, such as internet, intranet and extranet.
10. Investigate network security.

4.0 Introduction

In this day and age we as a global community are growing at a super-fast rate. Communication is a vital tool which aids us in breaking the distance barrier. Over the past decades there has been a monopoly in the telecommunications business, but now with the power of the internet, and super-fast data transfer rates people can communicate across the globe and only pay local rates.

4.1 Communications and connectivity

Computer communications is the process of sharing data, programs, and information between two or more computers. Connectivity is a concept related to using computer networks to link people and resources.

A communication system is made of four elements. Without these elements working in tandem, communication via the internet would not be possible. Whether wired or wireless, all communication systems must have these four elements.

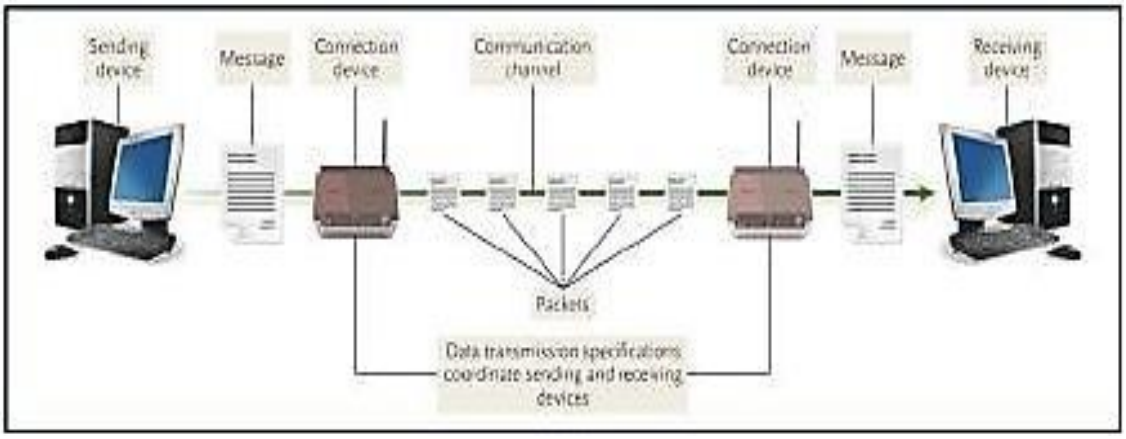


Figure 4.1a *Communication system*

Sending and receiving devices are simply computers, mobile devices such as PDAs, iPad, iPhone, tablets, mobile phones that transmit data toeach other.

Communication channels is the actual medium through which data gets transmitted from one device to another. This medium can be physical or wireless.

Physical mediums: are actually wires/cables used to connect two or moredevices such as twisted pair, coaxial and fiber-optic cables. *Twisted pair cables* are usually referred to as telephone lines and at 5/6 cables. It iscalled twisted pair because it consists of thin strands of intertwined copper wires.

Coaxial cable has a solid copper core in the middle which is insulated thick rubber coating. Coaxial cables are usually used for transmitting television signals as well as connect computers. It is approximately 80 times faster in transmitting data than a twisted pair.

Fiber-optic cable is usually used as a backbone cable for extremely high speed data transfer. It transmits data as pulses of light through tiny tubes of glass. Since fiber-optic cable uses pulses of light, it is capable of transmitting data approximately 26,000 times than the twisted pair.

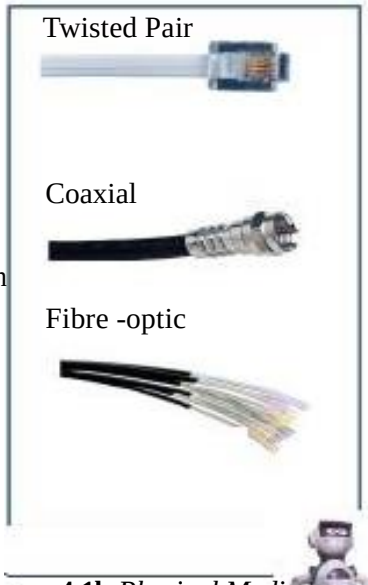


Figure 4.1b *Physical Medium*

Discovery Learning:

Find out if your mobile phone is Bluetooth/infrared capable. Try and transfer some objects amongst your friends and observe the datatransfer rate.

Wireless mediums: are connections that do not use any physicalwires/cables, instead ituses radio frequency, microwave, satellite andinfrared to transmit data over the air. Radio frequency (RF) uses radiosignals to communicate between wireless devices. The radio frequency standards are known as Bluetooth, Wi-Fi and WiMax. Bluetooth is a short range RF communication that can transmit data in any direction within ten metres.

Wi-Fi (Wireless Fidelity) also uses RF tocommunicate over short distances. It is based on certain standard and each standard has a different transmission speed (11Mbps – 600Mbps).

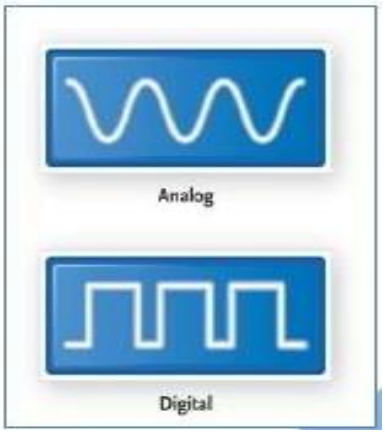
WiMax (Worldwide Interoperability for Microwave Access) simply extends the distance offered by Wi-Fi.

Microwave uses high frequencyradio waves and requires line of sight access between the two communicating devices similar to infrared. Microwave dish and *satellites* act as relay station to transmit microwaves where line of sight is not possible. *Infrared* uses infrared light waves to transmit data over very short distances approximately thirty centimeters requires the communicating devices to be in line of sight with no obstacles in between.

Connection Devices are devices that connect the devices to the communication channels for data to be transmitted. For example, amodem, network interface card (NIC) switch and routers

and routers are devices that connect several computers and mobile devices together. Since The computer understands digital language, everything that is sent and received must be in 0's and 1's.

The NIC, switch and routers send and receive everything in 0's and 1ss. However, if you are connected to the internet from your home/office via a telephone line then a modem is required for data transmission to take place.



Since the telephone lines were designed to carry voice data i.e analog signals, everything that leaves a computer system must be converted into analog form.

Modems do just that, convert the digital signal from the computer into analog signal from the sending computer and converts converts the analog signal back into digital signal on the receiving computer. This process is known as modulation-demodulation, hence the name modem (modilator-demodulator).

Figure 4.1c Connection Device Signals

While modems usually connect a single computer to the internet, a switch and a router can connect hundreds to thousands of computers in a network.

Analog – telephone signals; continuous electronic wave.
Digital – computer signals; presence or absence of an electronic pulse;on/off

Discovery Learning:

Describe how a switch and a router work. Check the internet if yourcomputer lab does not have these devices.

Types of Modems

Telephone can be either internal or external; connects computer directly to a telephone line.
DSL (Digital Subscriber Line) – uses standard phone lines; external and uses either USB or Ethernet ports.

Cable uses coaxial cable – same as your television; uses either USB or Ethernet ports.
Wireless does not use cables and also known as WWAN (wireless wide area network modem).
Signals are sent through the air where transfer speed or transfer rate is measured in bits per second; the higher the speed the faster the transfer rate.

Figure 4.1d *Types of modems*

Data transmission specifications – specify the rules and speeds at whichdata is transmitted over the network. Protocols and bandwidth specify the rules and speed respectively. *Protocols* are rules for exchanging data between computers. The standard protocol for the internet is TCP/IP(transmission control protocol/Internet protocol).

TCP/IP is a two-layer protocol. The higher layer, Transmission Control Protocol, manages the assembling of a message or file into maller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message. This process is known as *packetization.*

Discovery Learning:
Identify the sending/receiving devices, communication channels, connection devices and data transmission specification used in your school computer lab or office. Also find the IP address of your computer

The lower layer, Internet Protocol, handles the address part of eachpacket so that it gets to the right destination. Each gateway(router/server) on the network checks this address to see where to forward the message. Even though some packets from the same message are routed differently than others, they will be reassembled in the original order at the destination. This process is known as *identification.* TCP/IP uses domain name servers (DNS) that converts the numeric based IP address into textbased address (domain names – – see chapter 1 pg 7).

Bandwidth is the capacity of the communication channel that determines the volume of data that can be transmitted in a given amount of time.

Figure 4.1e below shows the bandwidth for each channel type. Bandwidth is measured in bits per second (bps).

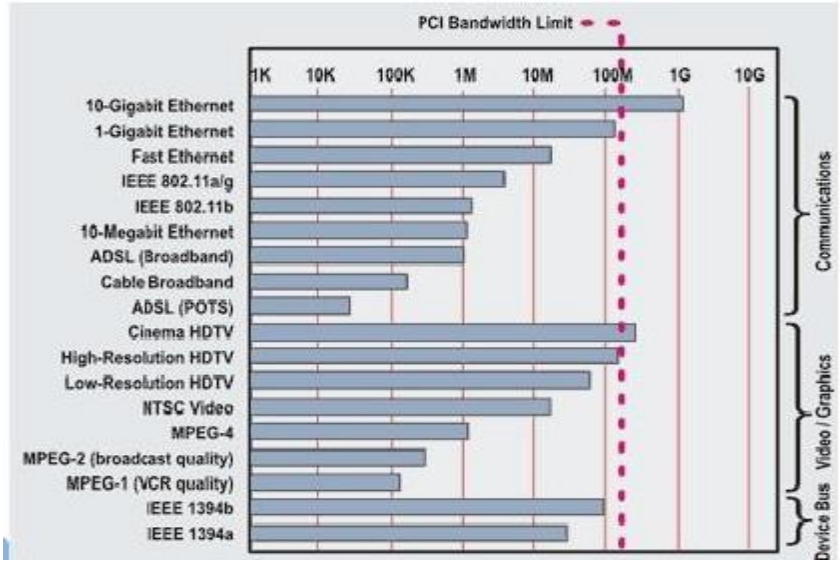


Figure 4.1e *Bandwidth Capacity*

There are four categories of bandwidth:

Voiceband also known as low bandwidth, is used for standard telephone communication. It is effective for transmitting text documents however it is too slow for many types of transmission, including high-quality audio and video.

Medium band is used in special leased lines to connectservers as well as transmit data over long distances. This band width is capable of very high-speed data transfer.

Broardband is widely used for DSL, cable and satellite connections to the internet. Several users can simultaneously use a single broadband connection for high-speed data transfer.

Baseband is widely used to connect individual computers that are located close to one another. Like broardband, it is able to support high-speed transmission. Unlike broadband, , however, baseband can only carry a signal at one time.

Discovery Learning:

Figure 4.1e does not show the capacity of fiber-optic cable. Find the different categories of fiber-optic cables and their respective bandwidth capacity.

Review Exercise 4.1

True/False

a) A communication system is made up of sending and receiving devices only.

b) Data specification transmission is usually referred to as protocols.

c) Bandwidth is measured in bytes per second.

d) Wi-Fi stands for Wireless Fidelity.

Completion

a) _____ is a short range RF that can transmit data in any direction.

b) The signals carried over the telephone lines are _____ signals.

c) A(n) _____ device that coverts digital signals to analog and vice versa.

d) _____ cables transmit data as pulses of light.

Short Answer Questions

a) What is th difference between Kbps, Mbps and Gbps?

b) Give at least two weaknesses of wireless communication systems.

c) Give an example of asynchronous transmission.

d) Describe the function of a modem.

4.2 Methods and modes of data transmission

Asynchronous and synchronous communication refers to methods by which signals are transferred. These signals allow computers to transfer data between components within the computer or between the computer and an external network.

In *asynchronous transmission*, the method frequently used with microcomputers, data is sent and received one byte at a time. Asynchronous transmission is often used for terminals with slow speeds. Its advantage is that the data can be transmitted whenever convenient for the sender. Its disadvantage is relatively slow rate of data transfer.

Synchronous transmission is used to transfer great quantities of information by sending several bytes or a block at a time. For the data transmission to occur, the sending and receiving of the blocks of bytes must occur at carefully timed intervals. Thus, the system requires a synchronized clock. Its advantage is that data can be sent very quickly. Its disadvantage is the cost of the required equipment.

All communications channel has a direction associated with it.

Figure 4.2a shows the different directions of communication.

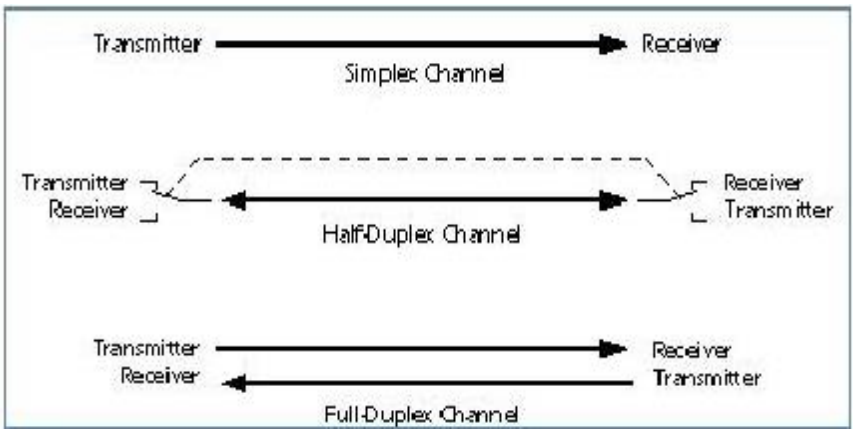


Figure 4.2a *Channel Type*

Discovery Learning:

A communication channel can never transmit data at its full capacity. Determine the factors that affect the transmission for both the physical and wireless mediums.

The message source is the transmitter, and the destination is the receiver.A channel whose direction of transmission is unchanging is referred to asa *simplex channel*. For example, a radio station is a simplex channel because it always transmits the signal to its listeners and never allows them to transmit back.

A *half-duplex channel* is a single physical channel in which the direction may be reversed. Messages may flow in two directions, but never at thesame time, in a half-duplex system. In a radio telephone (RT) call, oneparty speaks while the other listens. After a pause, the other party speaks and the first party listens.

A *full-duplex channel* allows simultaneous message exchange in both directions. It really consists of two simplex channels, a forward channeland a reverse channel, linking the same points. The transmission rate of the reverse channel may be slower if it is used only for flow control of the forward channel. Fiber-optic, twisted pair and all wireless communication channels are full duplex.

Review Exercise 4.2

True/False

a) In asynchronous communication, both the sending and receiving devices must work on the same clock rate.

b) If you use a modem for your internet connection, the channel type is full duplex.

c) Weather affects the transmission over the wireless medium.

Completion

a) In a _____ communication, a connection must be established between the sending and receiving device before data transmissioncan occur.

b) _____ duplex channel carries signals both ways but through separate wires.

c) Asynchronous transmission is also known as _____transmission.

Short Answer Questions

a) List some factors that affect the transmission through physical mediums?

b) How can the factors mentioned in (a) be minimized?

c) Give at least one advantage of asynchronous transmission over synchronous transmission?

4.3 Computer Networks

A computer network is formed when two or more computersare connected to each other either to exchange data, share information and resources.

Network connections between computers are typically created using cables (wires). However, connections can be created using radio signals (wireless/wi-fi), telephone lines (and modems) or even, for very long distances, via satellite links.

Using a computer connected to a network allows us to:

- Easily share files and data
- Share resources such as printers and Internet connections
- Communicate with other network users (e-mail, instant messaging, video-conferencing, etc.)
- Store data centrally (using a file server) for ease of access and back-up

Keep all of our settings centrally so we can use any workstation
In particular, if we use a computer connected to the internet, we can:

- Make use of on-line services such as shopping (e-commerce) or banking
- Get access to a huge range of information for research
- Access different forms of entertainment (games, video, etc.)
- Join on-line communities (e.g. MySpace, Facebook, etc.)

Specialized terms that is used to describe computer networks:

Network Interface Card (NIC) these are expansion cards located within the system unit that connect the computer to a network.

Network Operating System (NOS) control and coordinate the activities of all computers and other devices on a network.

Client – a node that requests and uses resources available from other nodes.

Server – a node that shares resources with other nodes.

Host – any computer system that can be accessed over a network.

Switch – a central node that coordinates the flow of data by sending messages directly between sender and receiver nodes.

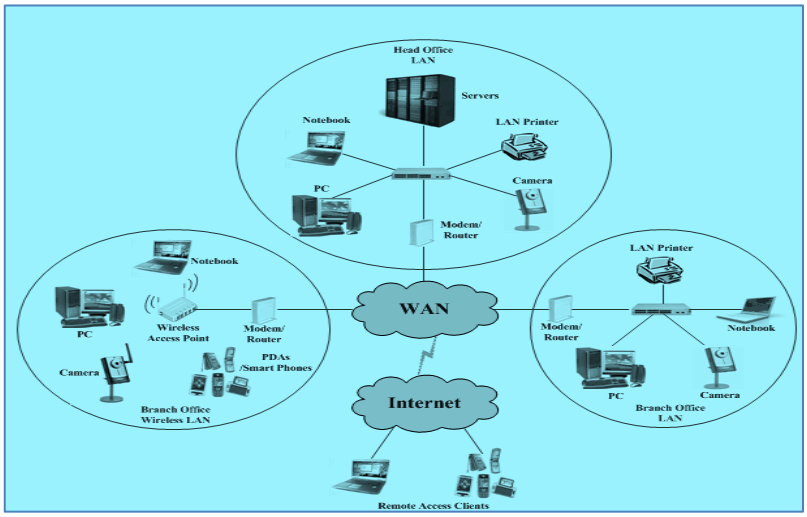


Figure 4.3a Network Connections

A *router* is a network device that connects together two or more networks. A common use of a router is to join a home or business network (LAN) to the Internet (WAN). The router will typically have the Internet cable plugged into it, as well as a cable, or cables to computers on the LAN as shown in figure 4.3b.

Alternatively, the LAN connection might be wireless (WiFi), making the device a **wireless router**. (A wireless router is actually a router and wireless switch combined)

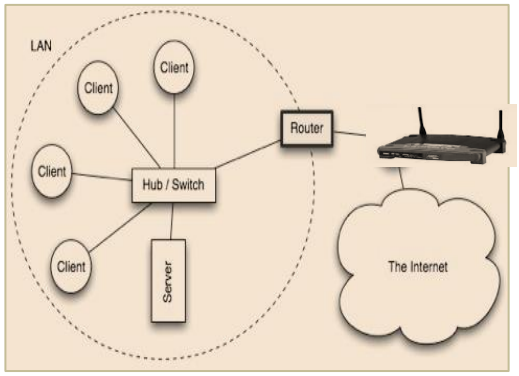


Figure 4.3b Network connection using a router

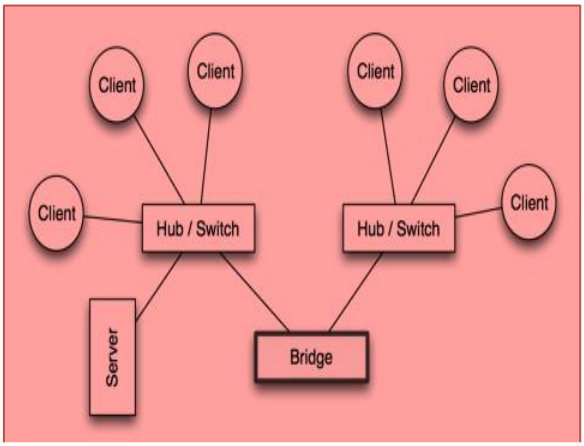


Figure 4.3c Network connection using a bridge

A *bridge* is a network device that typically links together two different parts of a LAN. Whereas a router is usually used to link a LAN to a WAN (such as the internet), a bridge links independent parts of a LAN so that they act as a single LAN.

If you wish to protect your whole LAN from hackers out on the Internet, you would place a firewall between the LAN and the Internet connection. A *firewall* blocks unauthorized connections being made to your computer or LAN. Normal data is allowed through the firewall (e.g. e-mails or web pages) but all other data is blocked.

4.4 Network Types

A network may consist of only microcomputers or a mixture of microcomputers and mobile devices. Each network type is distinguished from each other by the geographical area it covers. There are five types of network. They are LAN, WLAN, MAN, WAN and PAN.

Local Area Network (LAN) – are networks that connect nodes which are usually within the same room, offices, rooms within the same buildingand even homes. LANS can be spread within a radius of one hundred metres from the main building. It is typically owned or controlled by a single organization. LANs are now commonly used by individuals in their homes and apartments. These LANs, called *home networks*, allow different computers to share resouces, including a common internet connection. **Figure 4.4a** illustrates a local area network.

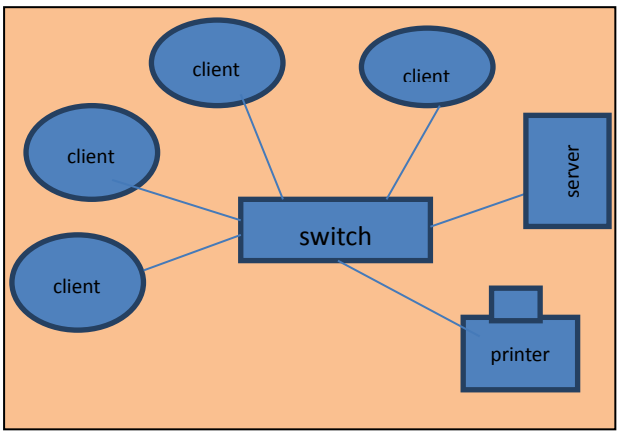


Figure 4.4a LAN

Wireless LAN (WLAN) is a LAN that uses radio signals (WiFi) to connect computers instead of cables. At the centre of the WLAN is a wireless access point or base station that interprets incoming radio frequencies and routes communications to the appropriate devices. **Figure 4.4b** illustrates a wireless local area network.

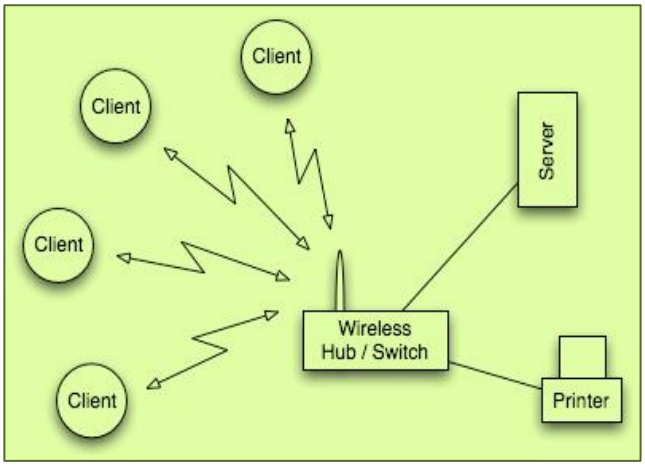


Figure 4.4b Wireless LAN

Metropolitan Area Network (MAN) is a network that extends far beyond the reach of a LAN. It usually connects offices that are spread around acity or even across multiple cities within an approximate distance of one hundred and fifty kilometers. MAN is typically owned by a group of rganizations who set/select the protocols and bandwidth in place fordata transmission to take place. **Figure 4.4c** illustrates a metropolitan area network.

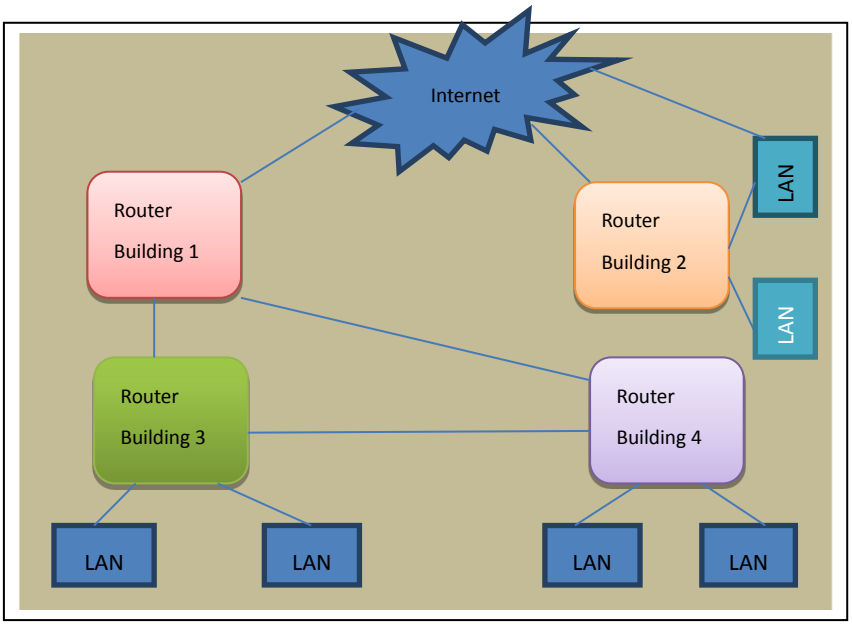


Figure 4.4c Metropolitan Area Network

Personal Area Network (PAN) is a wireless network formed spontaneouly within a very small area. It can be formed by devices like our laptop, mobile phone and cordless mouse and keyboards which can be connected to each other spontaneously. This can also be regarded as an ad-hoc network which sets *Bluetooth RF* for data transmission.

Bluetooth devices contain small, low-power radio transmitters and receivers. When devices are within a maximum range of 30 feet of other Bluetooth devices, they detect each other and can be 'paired' (connected). **Figure 4.4d** illustrates a bluetooth connection.

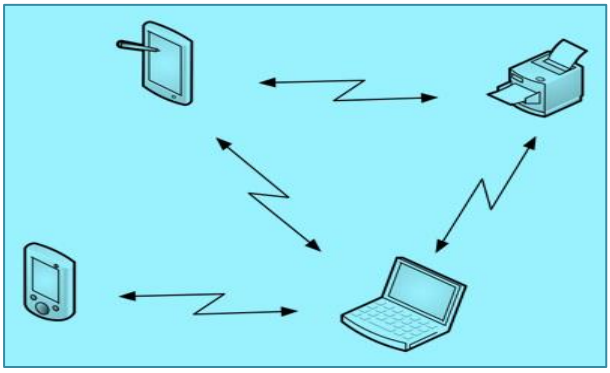


Figure 4.4d Bluetooth devices

Wide Area Network (WAN) is a network that spans the entire globe such as the internet. Because WANs are often geographically spread over large areas and links between computers over long distances, they often use quite exotic connections technologies: optical fiber (glass) cables, satellite radio links, microwave radio links, etc. **Figure 4.4e** illustrates a wide area network.

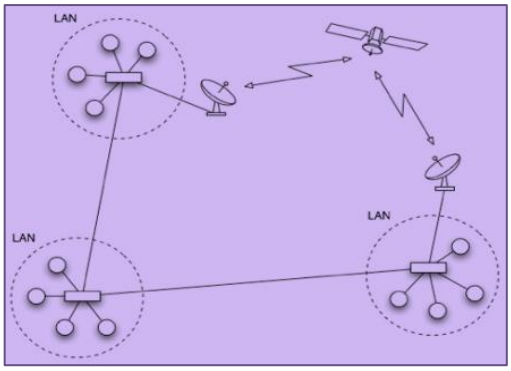


Figure 4.4e Wide Area Network

Discovery Learning:

What is the difference between a LAN, a MAN, a WAN and a PAN

Review Exercise 4.4

True/False

a) PAN can also be regarded as LAN.

b) Internet is an example of WAN.

c) In a LAN environment a network gateway device can connect several groups even if their configurations are different.

Completion

a) _____ connects several cities even regions.

b) A printer is a device that is usually shared in _____environment.

c) _____ any device that is connected to a network.

d) _____is a computer specialist responsible for efficient network operations and implementation of new networks.

Short Answer Questions

a) What is the difference between LAN and WLAN?

b)Give at least two advantages and two disadvantages of a LAN, a MAN, a WAN and a PAN.

c) Discuss network types including local area, home, wireless, personal, metropolitan, and wide area networks.

4.5 Network Architecture

Network architecture describes how a network is arranged and how theresources are coordinated and shared.It is divided in two major parts: topology and strategy. Network topology describes how a network is configured and arranged while strategies define how resources are shared. There are six different topologies that exist today.

Bus network is where each device is connected to a common cable calleda bus or a backbone and all communication travel along this bus. **Figure 4.5a** illustrates a bus network.

Figure 4.5a *Bus Network*

Figure 4.5b *Ring Network*

Ring network is where each device is connected to two other devices, forming a ring. Both the bus and ring topology passes the message from device to device till it reaches its correct destination. **Figure 4.5b** illustrates a ring network.

Figure 4.5c *Star Network*

Star network is where each device is connected to a central device usually a switch. When a node sends a message, it first goes to the switch which then verifies and forwards the message to the correct destination device. The star network is the most widely used network topology in the world.

Figure 4.5c illustrates a star network.

Tree network is also known as a hierarchical network where each device is connecting to anotherdevice which may be connected to other devices. It forms an upside down tree where the root device is usually the most powerful. **Figure 4.5d** illustrates a tree network.

Figure 4.5d *Tree Network*

Hybrid network is a mixture of allother topologies. Bigorganizations have lots of smallernetworks based on differing topologies which are then interconnected. For example, USP has twelve member countries and in each campus there are several computer labs. Each of these labs are setup using the star configuration which then is connected via a backbone cable, microwave dish and satellite forming a tree and mesh network as well. **Figure 4.5e** illustrates a hybrid network.

Figure 4.5e *Hybrid Network*

For *Mesh network* there is no particular configuration; Rather the devices are connected toeach other on the fly Especially in the wireless domains. It is best suited for WLANs and PANs. **Figure 4.5f** illustrates a mesh ne twork.

Figure 4.5f *Mesh Network*

Discovery Learning

List two advantages and disadvantages of each of the network architectures.

Review Exercise 4.5

True/False

a) The architecture of the network describes its topology and strategy.

b) In a hierarchical network, a computer serving other computers can also be hosted by other computer.

c) Messages are usually passed from one computer to another till it reaches its destination in a star network.

d) Mesh network can be considered as an ad hoc network.

Completion

a) A _____ is a device that usually forwards packets to the correct computer in the star network.

b) Large organizations usually have a _____ network setup.

c) Network that is formed mostly by wireless devices on the move is called _____ network.

Short Answer Questions

a) Describe how a PAN is formed?

b) Which topology is the most common and why?

c) What is the main reason some large organizations have to implement a hybrid network?

d) Identify which network topology relates to which network type.

e) Draw the diagram of the topology used in your school computer labor office. Properly name the sending and receiving devices, channel,connection devices and protocols used.

4.6 Network Strategies

A network strategy describes how resources and information is coordinated and shared. The most common network strategies are terminal, client/server, peer-to-peer and distributed.

In a terminal server network, processing power is centralized in onelarge computer (server), which can handlelarge number of connections.All nodes connected to this server are either terminals with no or li ttle processing power or microcomputers running special terminal emulation such as Windows Remote Desktop. For example, most airline reservation systems are terminal server networks. The server maintains all airlines schedules including rates, seat availability, bookings and light arrival/departures. Travel agents use terminals to connect to the server to make reservations. Although the tickets may be printed along with travel itineraries at the agent's desk, nearly all processing is done by the server.

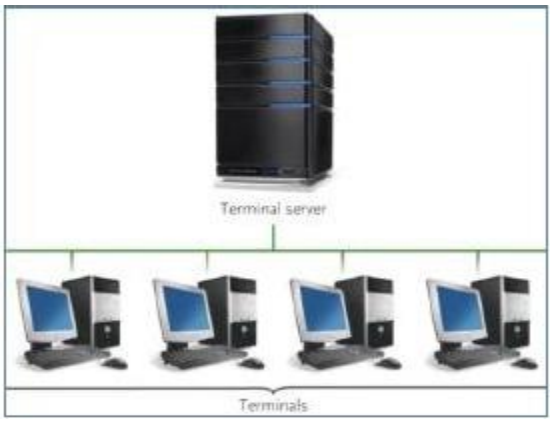


Figure 4.6a *Terminal Server model*

Discovery Learning

Describe how a point of sale (POS) system works in most supermarkets.

In a *client/server network*, the host computer usually the server coordinates resources to other computers (clients) connected to it. The software running on the client requests for information and services from the server which then responds to individual clients. In a network, the client/server model provides a convenient way to interconnect programs that are distributed efficiently across different locations.

Computer transactions using the client/server model are very common. For example, to check your bank account from your computer, a client program in your computer forwards your request to a server program at the bank. That program may in turn forward the request to its own client program that sends a request to a database server at another bank computer and to retrieve your account balance.

The balance is returned back to the bank data client, which in turn serves it back to the client in your personal computer, which displays the information for you.

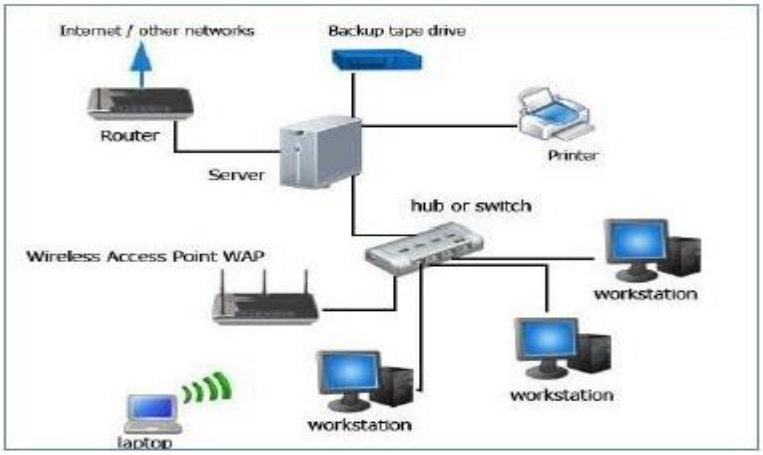


Figure 4.6b *Client/Server model*

Discovery Learning:
Select any organization and find out how the client/server model works for this organization. You may draw a diagram like figure 4.6b *to explain.*

In a *peer-to-peer network (P2P)*, nodes have equal processingcapabilities and can act as both the client and a server. It is a type of transient internet network that allows a group of computer users with the same networking program to connect with each other and directly access files from one another's hard drives.

Napster and Gnutella are examplesof this kind of peer-to-peer software. Major producers of content,including record companies, have shown their concern about what theyconsider illegal sharingof copyrighted content by suing some P2P users.

Meanwhile, corporations are looking at the advantages of using P2P as away for employees to share files without the expense involved in maintaining a centralized server and as a way for businesses to exchange information with each other directly.

Discovery Learning:

Select one example of a P2P model and describe how it works. You may do your lab first to be able to fully understand how it works.

In *distributed processing networks*, processing capability is shared acrossmultiple nodes usually servers dispersed at different locations. This strategy is common for very large organizations like banking industries.

For example, ANZ bank has it main server in Melbourne Australia, butfor Fiji customers, ANZ house has its own server that does theprocessing for its Fiji customers. The account details are then replicated to the main headquarters servers in Melbourne.

Note: you cannot have a network setup without either of the networktype, topology and strategy. If one is not implemented correctly, the entire network will collapse. So when designing networks, you must first describe the network type to be used, then the topology and finally the strategy. In most cases, the topology in fact indirectly clarifies which strategy and type is appropriate for a particular setup so choosing thetopology first helps.

Review Exercise 4.6

True/False

a) Star topology is the basis for a peer-to-peer model.

b) In a P2P model a computer can serve both as a client and server.

c) With distributed processing, everything processed at the main server.

d) A web browser is a sever program

Completion

a) Windows _____ desktop is emulation software that enables terminal networking.

b) _____ software enables computers to connect to each other directly without a central server for exchanging files like music and videos.

c) A _____ server handles all the printing jobs in a large organization.

d) In a(n) _____ processing network, computing power is located and shared at different locations.

Short Answer Questions

a) What are the advantages and disadvantages of using a peer-to-peer system?

b) Explain why the client/server model is most widely used?

c) What are the advantages of a distributed processing system?

4.7 Organizational Networks

An *internet* provides the network connections that link computers together.

An *intranet* is the name given to a private network that provides similar services to the internet: e-mail, messaging, web pages, etc. However, these services are only for the users of the intranet – they are private, not public (unlike Internet services which are generally public). Businesses and other organizations often have intranets for use by their employees.

An *extranet* is a private network that connects more than one organization. It can be viewed as an extension for an organization's intranet that is extended to users outside the organization.

Discovery Learning:

Describe the typical uses of internet, intranet and extranet?

4.8 Network Security

A *proxy server* is a computer setup to share a resource, usually an Internet connection. Other computers can request a web page via the proxy server. The proxy server will then get the page using its internet connection, and pass it back to the computer who asked for it.

Proxy servers are often used instead of router since additional software can be easily installed on the computer such as anti-virus, web filtering etc.

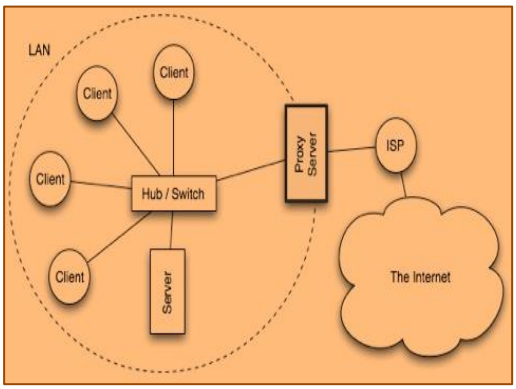


Figure 4.8a Proxy Server

A *firewall* is a device, or a piece of software that is placed between your computer and the rest of the network (where the hackers are!)

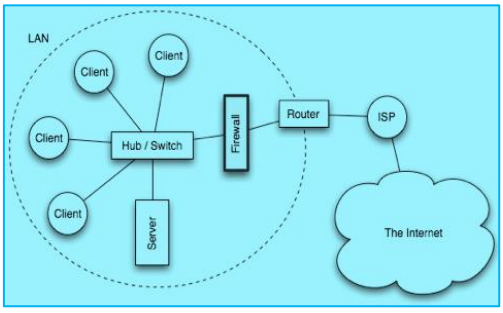


Figure 4.8b Firewall

Intrusion detection systems (IDS) work with firewalls to inspect all incoming and outgoing network traffic and identifies suspicious patterns that may indicate a network or system attack from someone attempting to break into or compromise a system.

Virtual private networks (VPN) create a secure private connection between a remote user and an organization's internal network. It enables a computer to send and receive data across shared or public networks as if it is directly connected to the private network, while benefiting from the functionality, security and management policies of the private network.

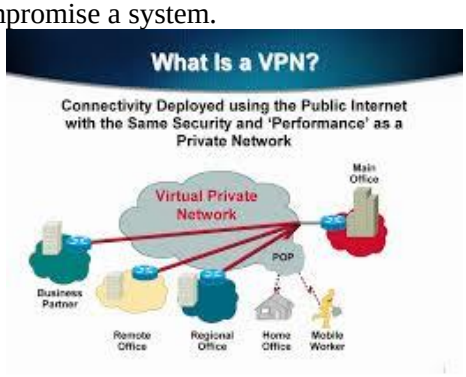


Figure 4.8c Virtual Private Networks

Discovery Learning:

If you were asked to build a small, internet-connected network from scrtach, what would you need to do?

4.1 Summary

1. Communication systems transfer data from one location to another.
   It comprises of four elements:
   - ✓ Sending and receiving devices
   - ✓ Communication channels
   - ✓ Connection devices
   - ✓ Data transmission specifications (protocols)
2. Communication channels are either physical or wireless.
   Physical channels: twisted pair, coaxial and fiber-optic cables.
   Wireless channels: Radio frequency, microwave, satellite and infrared.

Channel	Description
Twisted pair	Twisted copper wire, used for standard telephone lines and Ethernet cables
Coaxial cable	Solid copper core, more than 80 times the capacity of twisted pair
Fiber-optic cable	Light carries data, more than 26,000 times the capacity of twisted pair
Radio frequency	Radio waves connect wireless devices including cell phones and computer components
Microwave	High-frequency radio waves, travels in straight line through the air
Satellite	Microwave relay station in the sky, used by GPS devices
Infrared	Infrared light travels in a straight line

3. Connection devices connect the sending and receiving devices to the communication channels. NIC, modem, switch and router arecommonly used connection devices.

4. Modems modulate and demodulate signals.

5. Major protocols in networking and internet are TCP/IP, FTP andHTTP.

6. Bandwidth is the capacity of the communication channel.

7. Network topology describes how a network is configured.

Topology	Description
Bus	Past; all devices connected to a bus
Ring	Past; each device connected to two other devices
Star	Present; each device connected to central switch
Tree	Present; each device connected directly or indirectly to central node; hierarchical topology
Hybrid	Present; combination of different topologies
Mesh	Present; each device connected to more than one other device

8. Network strategy describes how the resources in the network are shared.

Strategy	Description
Terminal	Centralized processing power, location and control; underutilized processing power of microcomputers.
Client/server	Clients request services; severs provide services and coordination; efficient network management software; expensive.
Peer-to-peer	All nodes act as client and server; easy and inexpensive; lacks security
Distributed	Nodes share resources from different locations; used in decentralized organizations.

Communication is the process of sharing data, programs and information between two or more computers.

An information systems (IS) effectiveness is measured in part by how efficiently it delivers information and a data communication system is what enables an IS to carry out this task. A data communication system also improves the flexibility of data collection and transmission. For example, people these days use portable and handheld devices, to communicate with the office at any time from your location. All web based applications such as E-mail, Instant messaging, Video conferencing, Internet telephone and E-commerce depend on a good data communications system to effectively deliver its services. By using the capabilities of data communication system, organizations are no longer restricted by physical boundaries. They can collaborate with other organizations, outsourcing certain functions to reduce costs, andprovide customer services.

Key Terms

network	node	GPS
bandwidth	terminal	WiFi
bits per second	client	WiMax
network type	server	Bluetooth
topology	channel	infrared
strategy	switch	satellites
router	NIC	fiber-optic
twisted pair	coaxial	radio frequency
ring	hybrid	star
mesh	microwave	bus
WAP	P2P	distributed
	workstation	host

4.1Review Questions – Multiple Choice

1) Which among the following is considered a line of sight

communication medium?

a. Broadcast radio

b. Satellite communication

c. Bluetooth

d. Infrared

2) _____ is the process of breaking down information sent or transmitted

across the Internet into small parts called packets.

a. Protocol

b. Bandwidth

c. Identification

d. Packetization

3) The essential features of this include identifying sending andreceiving devices, and packeting information for transmission acrossthe internet.

a. Simple mail transfer protocol

b. Transmission control protocol/Internet protocol

c. File transfer protocol

d. hypertext transfer protocol

4) A network in which the central computer is a host to a cluster ofother computers that in turn are hosts is called a ____ network.

a. Star

b. Bus

c. Ring

d. Hierarchical

Review Questions – Short Answers

1) Describe how a GPS works.

2) Explain the process of modulation and demodulation.

3) Describe the differences between the three major physical connection mediums: twisted-pair cable, coaxial cable, and fiber-optic cable.

4) What is a WLAN? How does it work?

5) Discuss the three types of RF: Bluetooth, WiFi and WiMax.

Research Question

6.) Select an example (Google, Yahoo, Facebook, YouTube, Wikipedia) from the internet or any other organization and describe how the network type, topology and strategy are tied together.

Chapter 5 

Programming

Being a programmer means you never stop learning. The environment we work in is constantly changing, so we have to keep up with the changes.

After completing this chapter, you will be able to:

1. Design programs using .NET framework 2.0 runtime
2. Understand Visual Basic variables and data types
3. Use decision structures (if then else statements)
4. Apply repetition structures (for….next loop, do loops)
5. Create user-defined functions and subroutines
6. Debug an application

5.0 Introduction

VB.NET is a simple, modern, object-oriented computer programming language developed by Microsoft to combine the power of .NET Framework and the common language runtime with the productivity benefits that are the hallmark of Visual Basic.

Visual Basic (VB) was introduced in 1991 and has become such a popular programming language for several reasons. It is easy to learn, which makes it an excellent tool for understanding elementary programming concepts. In addition, it has evolved into such a powerful and popular product that skilled Visual Basic programmers are in demand in the job market.

Visual Basic is fully object-oriented and compatible with many other languages using the .NET Framework. It is designed to allow the programmer to develop applications that run under Windows and/or in a Web browser without the complexity generally associated with programming. With very little effort, the programmer can design a screen that holds standard elements such as buttons, check boxes, radio buttons, text boxes, and list boxes. Each of these objects operates as expected, producing a "standard" Windows or Web user interface.

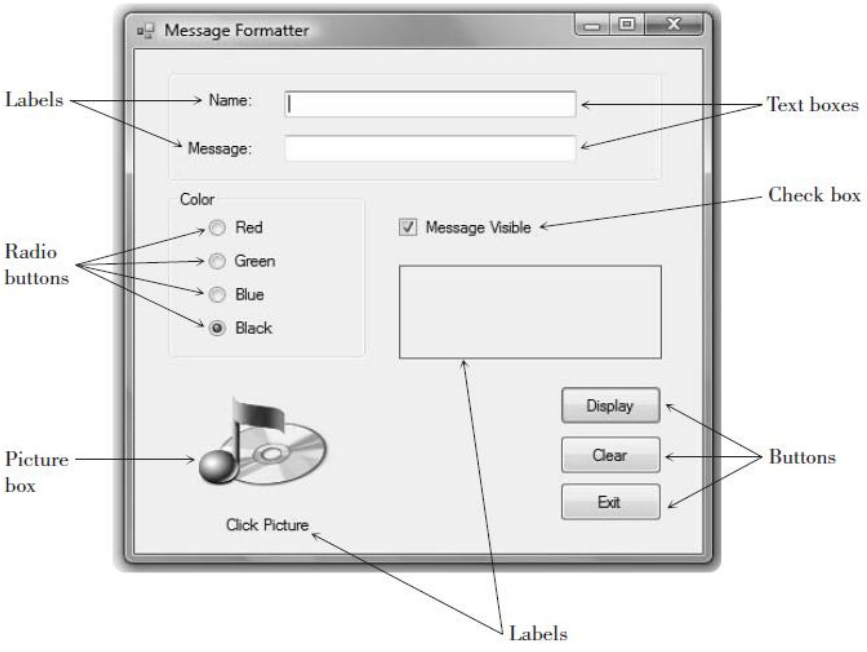


Figure 5.1 Graphical interface of a simple application developed using Visual Basic

Visual Basic is event-driven, meaning code remains idle until called upon to respond to some event (button pressing, menu selection … etc.). Visual Basic is governed by an event processor. Nothing happens until an event is detected. Once an event is detected, the code corresponding to that event (eventprocedure) is executed. Program control is then returned to the event processor.

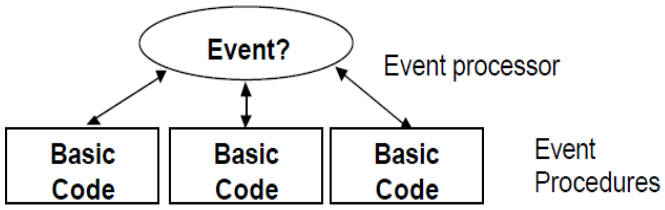


Figure 5.2 Visual Basic Event Processor

5.1 Visual Basic Application Files

A Visual Basic application, called a ***solution***, can consist of one or more projects. Each project can contain one or more form files.

Application (Project) is made up of:

- **Forms** - Windows that you create for user interface
- **Controls** - Graphical features drawn on forms to allow user interaction (text boxes, labels, scroll bars, command buttons, etc.) (Forms and Controls are **objects**.)
- **Properties** - Every characteristic of a form or control is specified by a property. Example properties include names, captions, size, color, position, and contents. Visual Basic applies default properties. You can change properties at design time or run time.
- **Methods** - Built-in procedure that can be invoked to impart some action to a particular object.
- **Event Procedures** - Code related to some object. This is the code that is executed when a certain event occurs.
- **General Procedures** - Code not related to objects. This code must be invoked by the application.
- **Modules** - Collection of general procedures, variable declarations, and constant definitions used by application.

As an example, the *HelloWorld* application that you will create later in this chapter creates the following files:

File Name	File Icon	Description
HelloWorld.sln		The solution file. A text file that holds information about the solution and the projects it contains. This is the primary file for the solution—the one that you open to work on or run your project. Note the "9" on the icon, which refers to VB version 9.
HelloWorld.suo		Solution user options file. Stores information about the state of the integrated development environment (IDE) so that all customizations can be restored each time you open the solution.
HelloForm.vb		A .vb file that holds the code procedures that you write. This is a text file that you can open in any editor. Warning: You should not modify this file unless you are using the editor in the Visual Studio environment.
HelloForm.resx		A resource file for the form. This text file defines all resources used by the form, including strings of text, numbers, and any graphics.
HelloForm.Designer.vb		A file created by the Form Designer that holds the definition of the form and its controls. You should not modify this file directly, but make changes in the Designer and allow it to update the file.
HelloWorld.vbproj.user		The project user option file. This text file holds IDE option settings so that the next time you open the project, all customizations will be restored.

Figure 5.3 Files in a Visual Basic "HelloWorld" Project

5.2 Integrated Development Environment

An Integrated Development Environment (IDE) is software that facilitates application development. It contains all the features needed to create, run, and test programs. It has an editor for entering program instructions, compiler for running and testing program and allows creation of Web-based and Windows-based applications.

In the context of .NET-based applications, *Visual Studio* is the most commonly used IDE. The other popular open source alternative is *Sharp Develop* which provides a similar facility and layout for .NET programming. Both these IDE's srun on Microsofts .NET framework.

This chapter will use *Microsoft Visual Studio Express Edition*, which is available for free download from the Microsoft site: http://www.visualstudio.com/en-us/downloads#d-2010-express or http://go.microsoft.com/fwlink/?LinkId=104679

Review Exercise 5.1

Short Answer Questions

a) Why is Visual Basic such a popular programming language?
b) What are some of the standard elements that can be placed on a Windows Form?
c) What are objects and properties? How are they related to each other?
d) What is the purpose of these Visual Basic file types: .slnand .vb?
e) Visual Basic is event-driven. What does this mean?
f) What is the purpose of an IDE?

Creating your first Program using Visual Studio IDE

Now, let's create the first Visual Basic application. The specification for the program is as follows:

Program Specification:

This simple application will display the message "Bula and Namaste!" in a label when the user clicks the *Push Me* button and will terminate when the user clicks the *Exit* button.

1. When you launch VB2008 Express version or above from the start menus or the desktop, the Integrated Development Environment (IDE) will look similar to Figure 5.4.

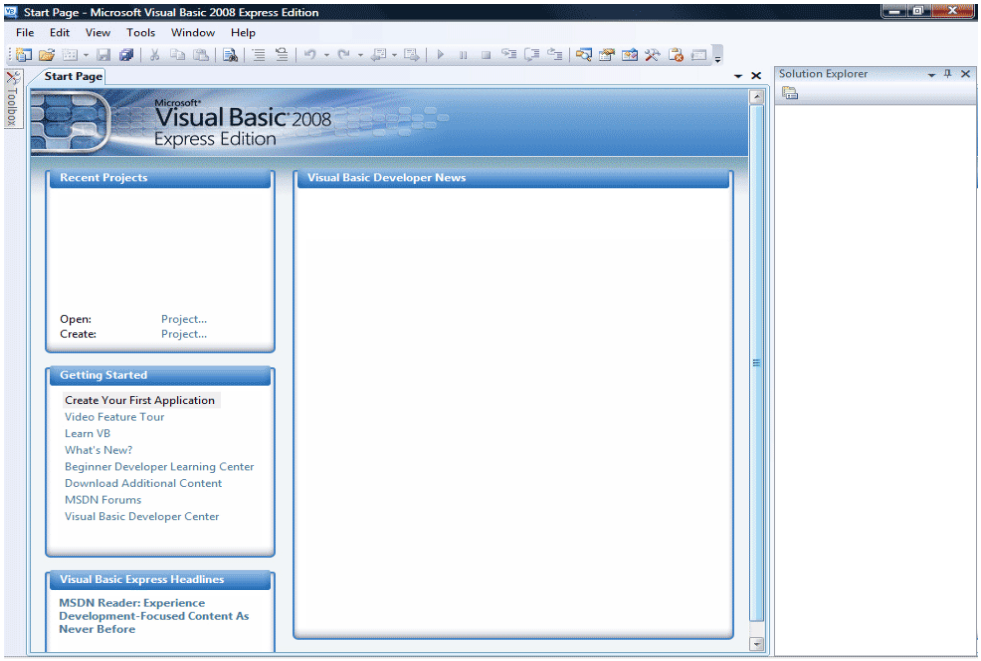


Figure 5.4 The Visual Basic 2008 IDE

2. To start creating your first application, you need to click on File on the menu bar and select New Project. The VB2008 New Project dialog box will appear, as shown in Figure 5.5

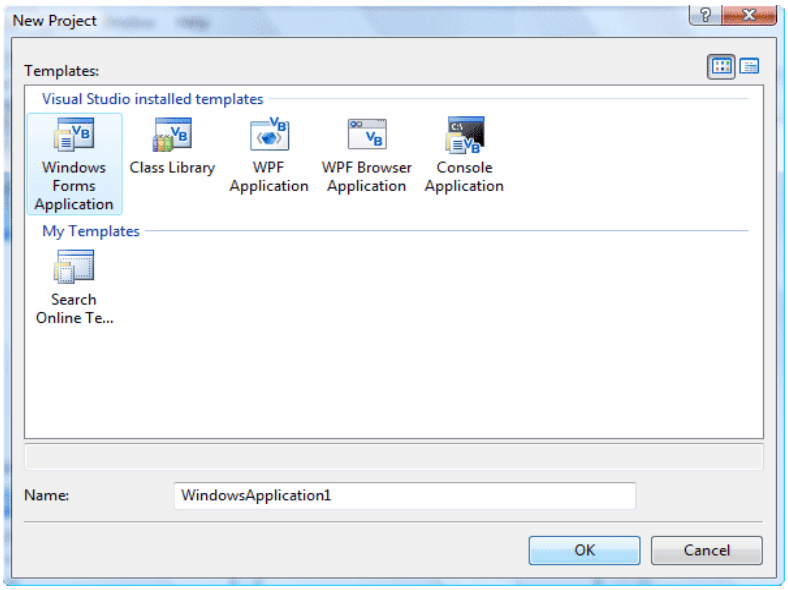


Figure 5.5 Visual Basic 2008 New Project Dialog Box

3. The dialog box (Figure 5.5) offers you five types of Visual Basic projects that you can create. For our purpose, we will select Windows Forms Application. At the bottom of this dialog box, you can change the default project name **WindowsApplication1** to some other name you like, for example, **MyFirstProgram**. After you have renamed the project, click OK to continue.

4. A new project will appear, as shown in Figure 5.6. It consists of an empty form, the common controls toolbox, the solution explorer and the Properties Window. (Use the view menu to display the appropriate windows if they are not visible)

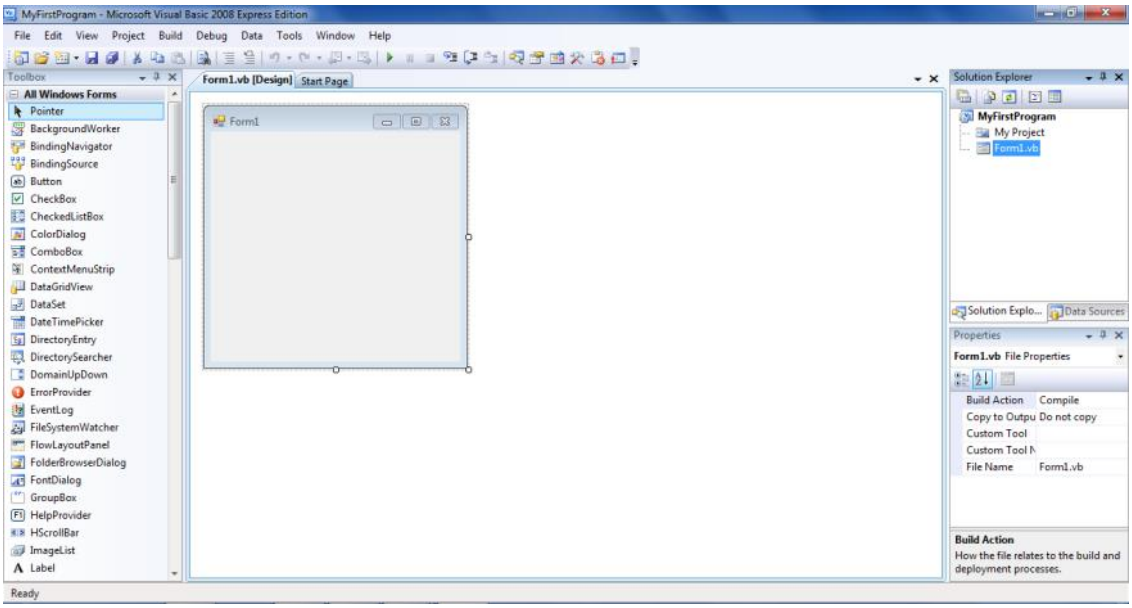
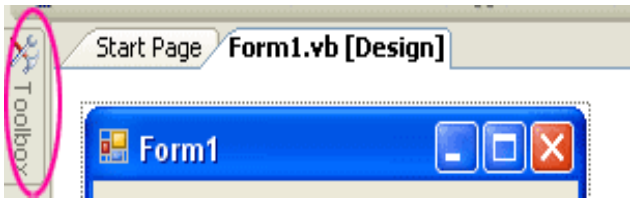
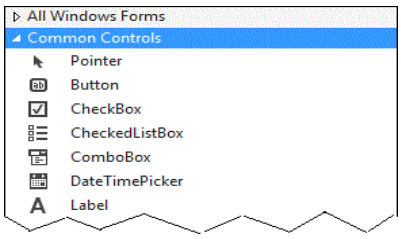


Figure 5.6 The Visual Studio Environment showing a new form

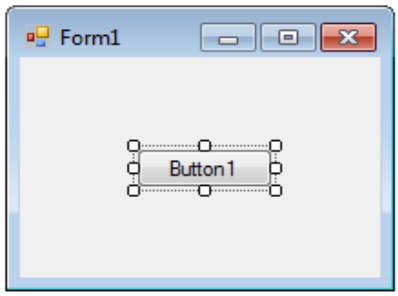
5. Form elements such as buttons, textboxes, and labels are known as *Controls*, and are kept in the *Toolbox* for ease of use. The Toolbox can be found on the left of the screen. In the picture below, you can see the toolbox icon next to Form1:



We will use the Common Controls toolbox. To see the common windows tools, click on the plus sign or arrow symbol next to Common Controls. You'll see a long list of tools:

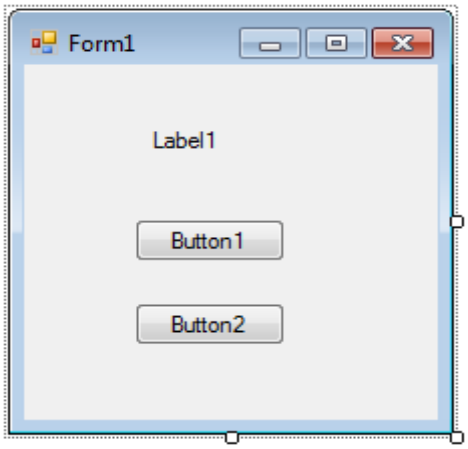


6. To add a *Button* to the form with the Common Controls displayed, do the following:
   - Locate the *Button* tool
   - *Drag and Drop* or *Double click* the icon
   - A button is added to your form



Ensure that the button appears in the middle of the form. (To move it down, hold your mouse over the button and drag to a new position. Also try resizing the button)

7. Similarly, add a second button and a label to the form. The project should now resemble the following:



8. To customize the interface for the users, on can set the appropriate properties for the controls. (Note: You also can set the properties of the controls in the properties window at design time or by using the code. Right click on the object (button and labels)and set the properties in the dialog that appears in the properties window as follows:

Objects	**Property**	**Settings**
Form1	Text	Hello World by [Your Name]
Label1	Name Text BorderStyle autosize	lblMessage Empty FixedSingle False
Command1	Name Text	PushMe btnPushMe
Command1	Name Text	Exit btnExit

9. After changing the property, the user interface should resemble Figure 5.7

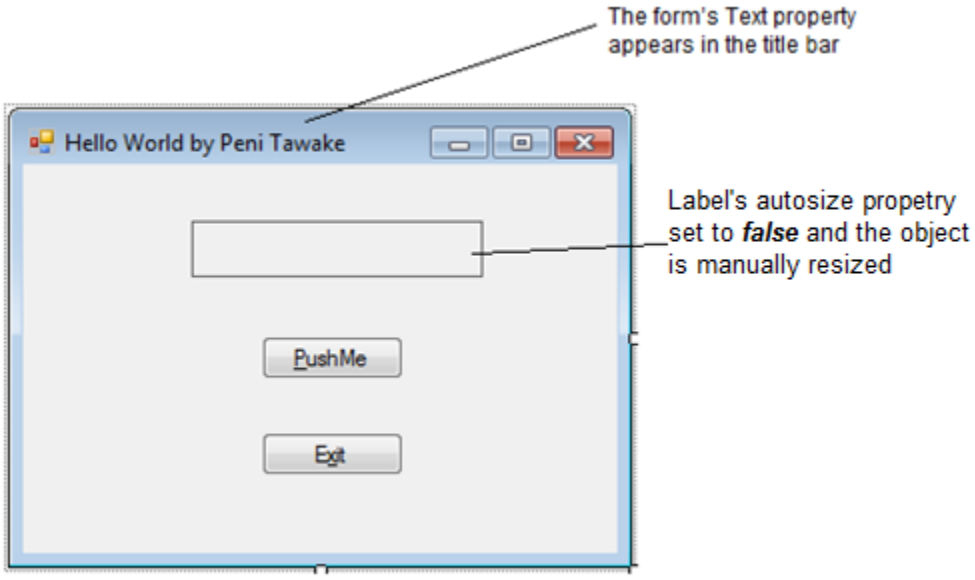


Figure 5.7 Completed User Interface (UI)

10. To run the program, use one of these three techniques:
    i. From the menu bar, click Debug
        a. From the drop down menu, click Start Debugging
    ii. Alternatively, click the run button  on the toolbar
    iii. Press F5, the keyboard shortcut key to the Start Debugging command.

    Your programme should now be launched.

    Congratulations! You have now created your very first program. It should look somewhat like Figure 5.7, but clicking on the *PushMe*button does not action anything yet. Click the red X  on the form to stop it from running. You will then be returned to the design environment.

11. Let's now code the btnPushMe_Click subroutine (type only the line highlighted in blue as the procedure should be created automatically on click event):

```
Private Sub btnPushMe_Click(ByVal sender As…
    lblMessage.Text = "Bula and Namaste!"
End Sub
```

    Run your application and see what happens. Yay!!! You have completed your first Visual Basic program.

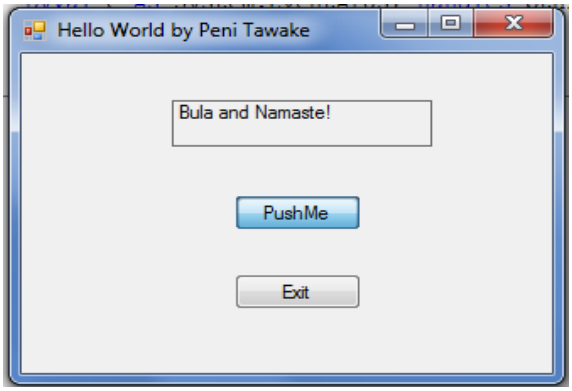


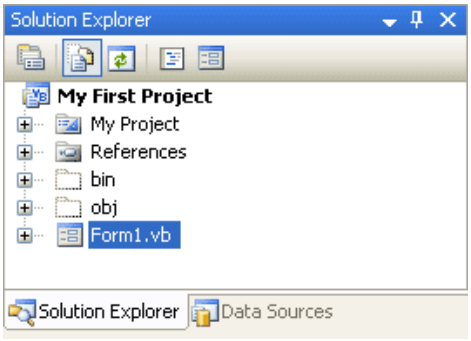
Figure 5.8: Running the *MyFirstProgram* Project

Similarly, you can double-click btn_Exit and code the click event as follows:

```
Private Sub btnExit_Click(ByVal sender As…
        Me.Close
End Sub
```

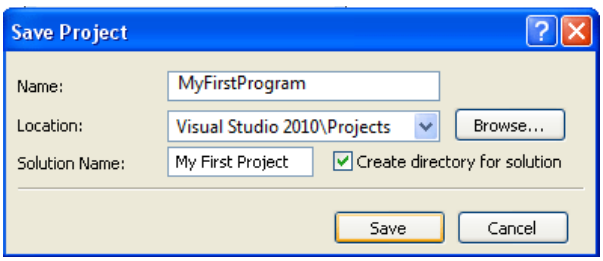
You can make the application more attractive by changing the colour and font- type and font-size of the controls.

12. The project is made up with a number of File as shown in the Solution Explorer window:



Always move the entire solution folder when you wish to transfer the code to a USP or submit to your teacher for marking.

To save your work, click **File > Save All**. Click on Browse to verify the location where the file will be saved.



Review Exercise 5.2

Short Answer Questions

a) What is the purpose of the Name property of a control?
b) What is the purpose of the Text property of a button? the Text property of a form?
c) Which property determines what appears on the form for a Label control?
d) What does PushButton_Click mean? To what does PushButton refer? To what does Click refer?

5.3 Writing good Visual Basic Applications

Planning is a crucial step in programming. Before you start writing a Visual Basic program, a good programmer has to ensure the following:

1. Have good design of the user interface
2. Define the properties for the elements on the interface
3. Design the solution for the problem (algorithm).

1. *Design the user interface* - When planning the user interface, one has to draw a sketch of the screens the user will see when the project is running. On the sketch, all the controls that is planned to be used in the application is shown and labeled. It is also important to consult with the users and make sure that they agree on the look and feel of the project before proceeding any further.
2. *Plan the properties*. For each object, write down the properties that you plan to set or change during the design of the form.
3. *Plan the Solution*. In this step, you plan the classes and procedures that will execute when your project runs. You will determine which events require action to be taken and then make a step-by-step plan for those actions. The actual Visual Basic code will be written later. During this planning stage, you will write out the actions using pseudocode, which is an English expression. Some people prefer describing the steps using a flowchart.

5.3.1 Object Naming Conventions

After completing the planning steps and obtaining approval from the users, can the programmer begin with the actual construction of the project. In the actual program implementation, the programmer does the following:

1. Defines the user interface and objects using the IDE.
2. Set the properties for the controls
3. Write the actual Basic code.

A convention has been established for naming Visual Basic objects. This convention is to use a three letter prefix (depending on the object) followed by a name you assign. A few of the prefixes are (we'll see more as we progress in the chapter):

Object	Prefix	Example
Form	frm	*frmHello*
Button	btn	*btnExit*
Label	lbl	*lblMessage*
Text	txt	*txtName*
Menu	mnu	*mnuSave*
Check box	chk	*chkChoice*
Option/Radio Button	opt	*optSelect*

When you select a name for an object, Visual Basic requires the name to begin with a letter or an underscore. The name can contain letters, digits, and underscores. An object name cannot include a space or punctuation mark and cannot be a reserved word, such as Button or Close or End or Print etc.. For example, btnExit, btnEnd and btnClose are legal.

> **Tip:**When you select a name for an object, Visual Basic requires the name to begin with a letter or an underscore. The name can contain letters, digits, and underscores. An object name cannot include a space or punctuation mark and cannot be a reserved word, such as Button or Close or End or Print etc..

Flow Chart Symbols

A flowchart is a diagrammatic representation of a program or a graphic representation of the steps needed to solve the programming problem. A flowchart is an outline that depicts (shows) events or actions and the sequence in which the actions must be taken to correctly solve the problem.

Flowchart Symbols	Explanation
	Indicates the beginning and end of a program.
	Indicates that a calculation should be performed or assigning a value to a variable.
	Indicates an input/read or an output operation.

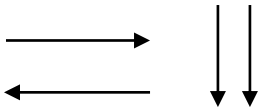
	Allows alternate courses of action based on a condition. A decision indicates a question that can be answered as yes or no or (true or false).
 Connector	Is used to eliminate lengthy flow lines. Its use indicates that one symbol is connected to another.
 Flowlines	Indicates the order in which operations should be performed.

Table 5.1 Flow chart symbols

Logical Structures

Three arrangements are used in programming to write structured programs. These are:

a. Sequence Structure
b. Selection Structure
c. Iteration (Loop) Structure

a. Sequence Structure

In the sequence structure one program statement follows another. There are no decisions to be made the boxes logically follow one another.

b. Selection Structure

The selection structure represents a choice. It occurs when a choice must be made. The outcome of this structure offers two (2) paths to follow when a decision must be made by a program. If…then…else structure is used to determine which of the two available actions to choose depending on whether a condition evaluates to true or false.

c. Iteration/Repetition (Loop) Structure

The loop/ iteration structure describes a process that may be repeated as long as a certain condition remains true.

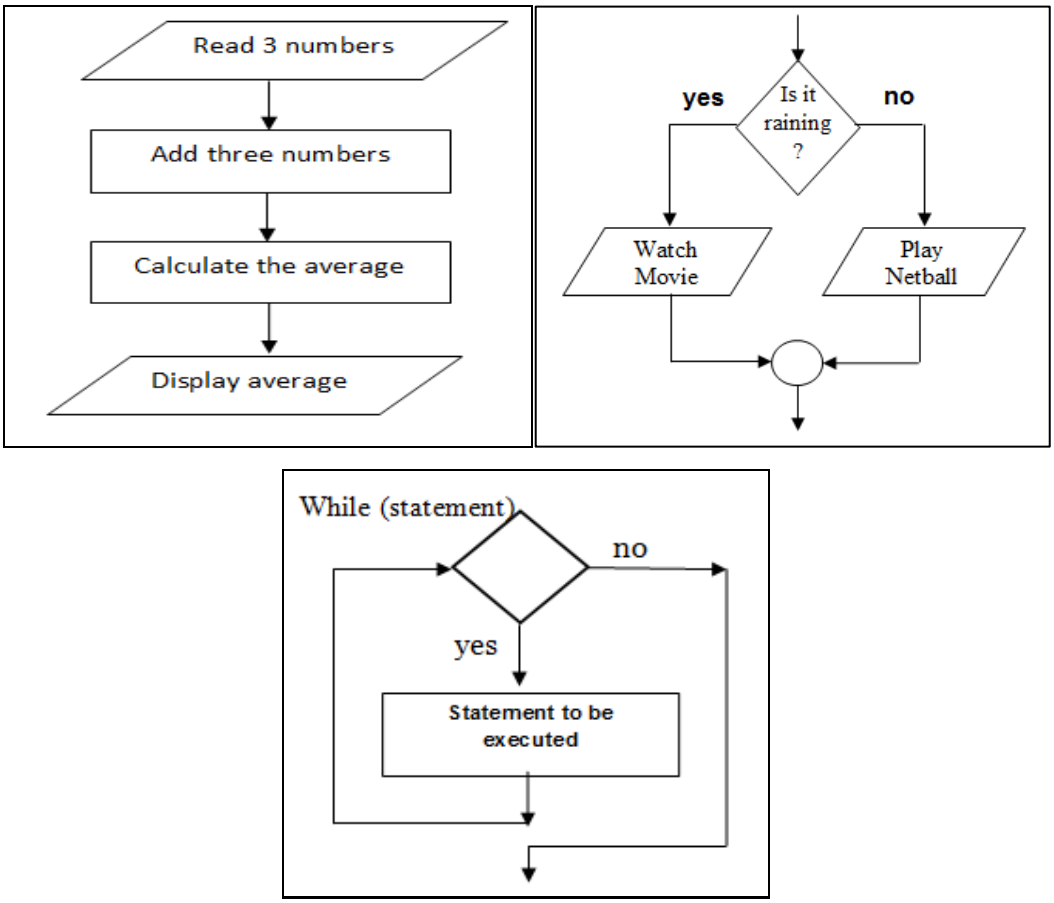


Figure 5.9 *a.) Sequence Structure b.)Selection structure c.) Iteration Structure*

Pseudocode Writing

Another technique called pseudo code (pronounced "soo-doo-code") is rapidly increasing in popularity. Also known as Structured English, allows a programmer to use English like sentences to write an explanations of what the program is supposed to do. The programmer uses certain keywords in much the same manner as if writing in a structured programming language.

For Figure 5.9 a), the pseudocode to calculate the average of three numbers will be similar to the following:

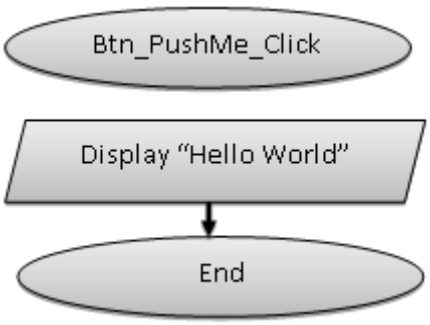
Start Procedure
Input three numbers
Calculate Total = Number 1 + Number 2 + Number 3
Calculate Average = Total / 3
Display Average
End of Procedure

The dialog box offers you five types of projects that you can create. As we are going to create a Windows application, we will select Windows Forms Application. At the bottom of this dialog box, you can change the default project name **WindowsApplication1** to some other name you like, for example, **MyFirstProgram**. After you have renamed the project, click OK to continue. A new Form will appear, as shown in Figure 5.8. It consists of an empty form, the common controls toolbox, the solution explorer and the Properties Window.

Review Exercise 5.3

Practical Task

1. Write the pseudocode and draw a flowchart to make a cup of coffee.
2. Draw a flowchart to find the sum of two numbers and display the sum.
3. Draw a flowchart that reads the age from the user and displays whether the person is eligible for voting or not. (Note that voting age in Fiji is 18 and above)
4. Create a project that displays the name of your School in a label when the Display button is clicked. The form should also have an Exit button
    a. Sketch the User Interface (provide appropriate names for the controls)
    b. State the properties of the objects (tabular format)
    c. Design the form using the IDE
    d. Code the project
5. Write the Visual Basic code for the following flowchart (don't write the procedure declaration Private Sub etc)



5.4 Introducing More Controls in Visual Basic

In the previous section, we learnt about labels and buttons. In this section you will learn to use several more control types such as text boxes, group boxes, check boxes, radio buttons, and picture boxes.

Each class of controls has its own set of properties. To see a complete list of the properties for any class of control, place a control on a form and examine the properties list in the Properties window.

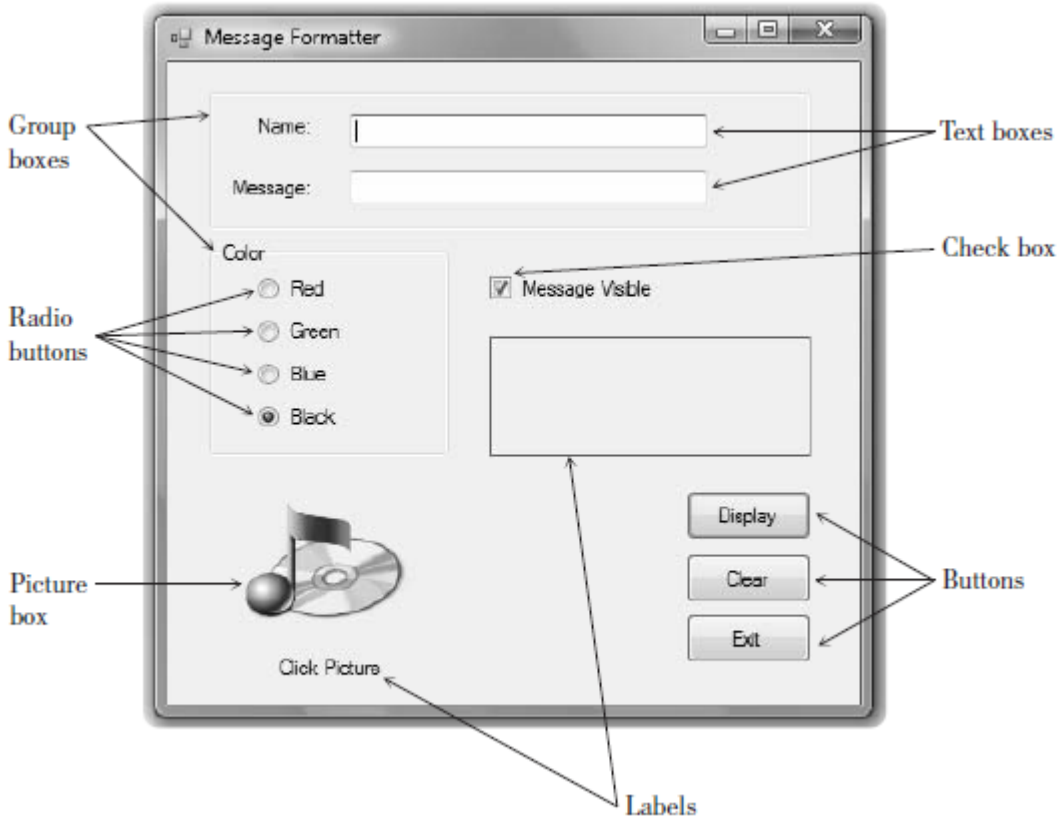


Figure 5.10*This form uses labels, text boxes, a check box, radio buttons, group boxes, and a picture box.*

5.4.1 Text Boxes

Use a **text box** control when you want the user to type some input. The form in Figure 9.10 has two text boxes. The user can move from one box to the next, make corrections, cut and paste if desired, and click the *Display* button when finished. If you want to display some text in a text box during program execution, assign a string literal to the Text property:

```
txtMessage.Text= "Watisoni, come here."
```

You can set the **TextAlign property** of text boxes to change the alignment of text within the box. In the Properties window, set the property to *Left*, *Right*, or *Center*. In code, you can set the property using these values:

```
txtMessage.TextAlign=   HorizontalAlignment.Left
```

You can display text in multiple lines in a textbox by changing the **Multiline property and WordWrap property** to True.

5.4.2 Masked TextBox

A specialized form of the TextBox control is the **Masked TextBox**. You can specify the format (the Mask property) of the data required of the user. At run time the user cannot enter characters that do not conform to the mask. For example, the phone number and FNPF number masks do not allow input other than numeric digits. You can select a format for the input mask in the Input Mask dialog box, which supplies the Mask property of the MaskedTextBox control.

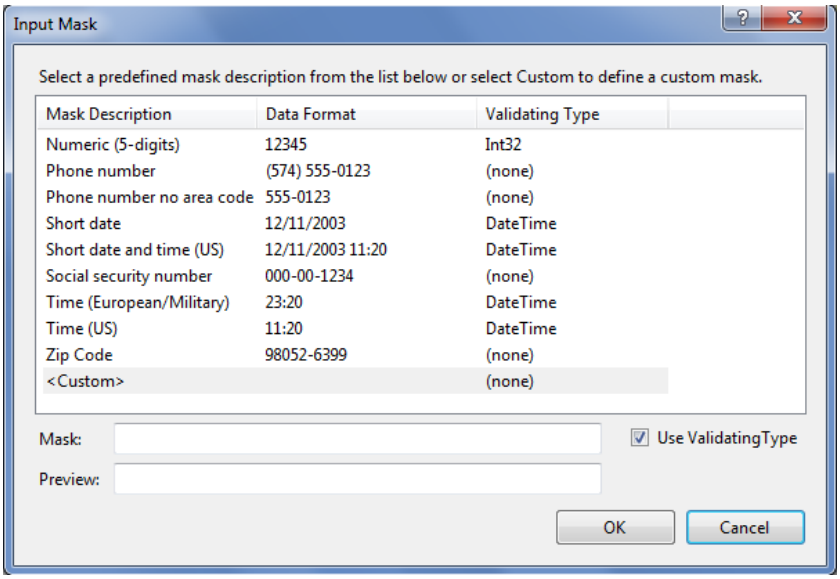


Figure 5.11 Mask property dialog for Masked Textbox

5.4.3 GroupBox

GroupBox controls are used as **containers** for other controls. Usually, groups of radio buttons or check boxes are placed in group boxes. Using group boxes to group controls can make your forms easier to understand by separating the controls into logical groups.

Set a group box's Text property to the words you want to appear on the top edge of the box.

5.4.4 Check boxes

Check boxes allow the user to select (or deselect) an option. In any group of check boxes, any number can be selected. The **Checked property** of a check box is set to False if unchecked or True if checked.

You can write an event procedure for the CheckedChanged event, which executes when the user clicks in the box. In the next section, when you learn about If statements, you can take one action when the box is checked and another action when it is unchecked. Use the Text property of a check box for the text you want to appear next to the box.

5.4.5 Radio Buttons

Use **radio buttons** when only one button of a group may be selected. Any radio button that you place directly on the form (not in a group box) functions as a group. A group of radio buttons inside a group box function together. The best method is to first create a group box and then create each radio button inside the group box.

When you need separate lists of radio buttons for different purposes, you must include each list in a separate group box. The Checked property of a radio button is set to True if selected or to False if unselected. You can write an event procedure to execute when the user selects a radio button using the control's CheckedChanged event. Set a radio button's Text property to the text you want to appear next to the button.

5.4.6 Picture Box

A **PictureBox control** can be used hold an image. You can set a picture box's **Image property** to a graphic file with an extension of .bmp, .gif, .jpg, .jpeg, .png, .ico,.emf, or .wmf. You first add your images to the project's resources; then you canassign the resource to the Image property of a PictureBox control.

Place a PictureBox control on a form and then select its Image property in the Properties window. Click on the Properties button to display a ***Select Resource*** **dialog box** where you can select images that you have already added or add new images (see Figure 5.12)

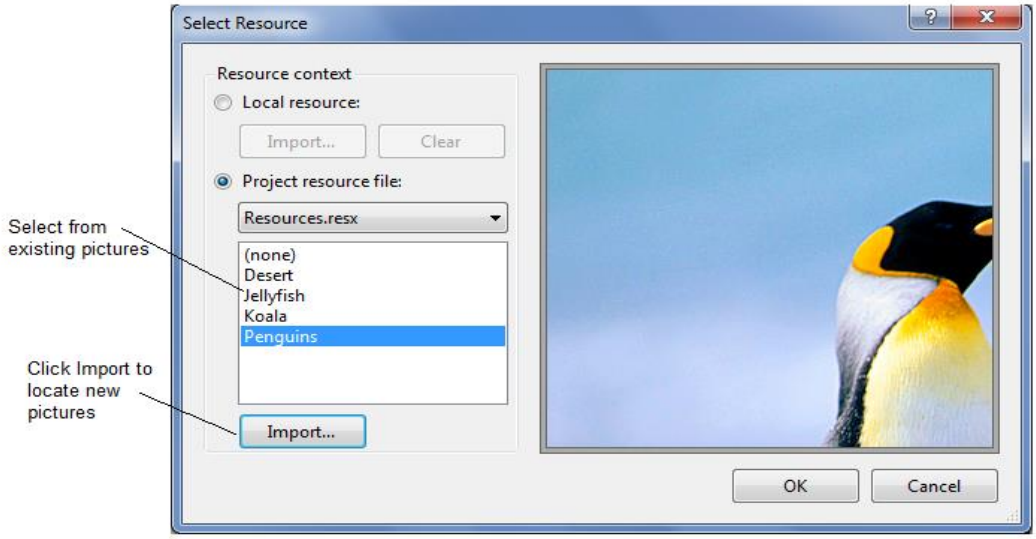


Figure 5.12 The Select Resource dialog box. Make your selection here for the graphic file you want to appear in the PictureBox control; click Import to add an image to the list.

Review Exercise 5.4

Short Answer Questions

a) You can display program output in a text box or a label. When should you use a text box? When is a label appropriate?
b) What would be the advantage of using a masked text box rather than a textbox?
c) How does the behavior of radio buttons differ from the behavior of checkboxes?
d) Write the Basic statements to clear the text box called Company TextBox and reset the insertion point into the box.
e) What will be the effect of each of these Basic statements?
   i. PrintCheckBox.Checked = True
   ii. ColorRadioButton.Checked = True
   iii. DrawingPictureBox.Visible = False
   iv. LocationLabel.BorderStyle = BorderStyle.Fixed3D
   v. CityLabel.Text = CityTextBox.Text
   vi. RedRadioButton.Enabled = True

5.5 Trying a Hands-on Programming Example (Message Formatter)

Program Specification:

Write a *Message Formatting* program that displays the message typed by the user in a label.

The user interface should also the user to type his/her name and message in a textbox and select the color for the message text (Red, Green, Blue Black). The form should also have buttons to *Display* and *Clear* the label and the *Exit* button should close the application. Change the name of the form to Main, and place "Message Formatter" in the title bar of the form.

A. Planning the Project

Sketch a form (Figure 9.13), which your users sign off on as meeting their needs.

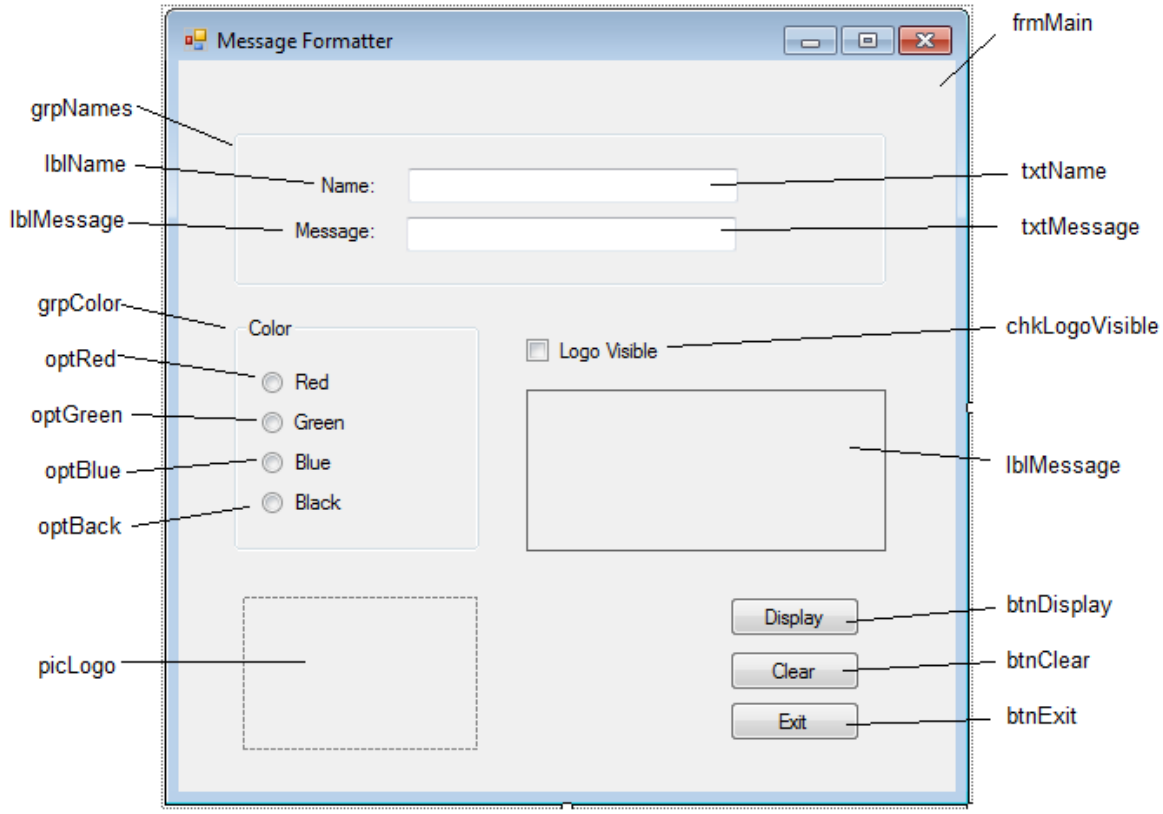


Figure 5.13 A Planning sketch of the form for the hands-on programming example.

Plan the Objects and Properties

Plan the property settings for the form and for each control.

Objects	Property	Settings

Form1	Text	Message Formatter
	Name	frmMain
NamesGroup	Name	grpName
	Text	Empty
NameTextBox	Name	txtName
MessageTextBox	Name	txtMessage
ColorGroup	Name	grpColor
	Text	Color
RedOptionButton	Name	optRed
	Text	Red
GreenOptionButton	Name	optGreen
	Text	Red
BlueOptionButton	Name	optBlue
	Text	Red
BlackOptionButton	Name	optBlack
	Text	Red
LogoPictureBox	Name	picLogo
	Image	[Choose own picture]
	SizeMode	StretchImage
LogoVisibleCheckbox	Name	chkLogoVisible
	Text	Logo Visible
MessageLabel	Name	lblMessage
	Text	Empty
	AutoSize	False
	BorderStyle	FixedSingle
	TextAlign	MiddleCenter
DisplayButton	Name	btnDisplay
	Text	Display
ClearButton	Name	btnClear
	Text	Clear
ExitButton	Name	btnExit
	Text	Exit

Plan the Event Procedures

You will need event procedures for each button. Write the actions in pseudocode, which is English language that is "like code."

Event Procedure	Actions - Pseudocode
chkLogoVisible_CheckedChanged	Show/Hide Logo equivalent to value of the checkbox option
optRed_CheckedChanged	Set Forecolor of lblMessage to Red
optGreen_CheckedChanged	Set Forecolor of lblMessage to Green
optBlue_CheckedChanged	Set Forecolor of lblMessage to Blue
optBlack_CheckedChanged	Set Forecolor of lblMessage to Black
btnDisplay_Click	Display the Message followed by the Name
btnClear_Click	Clear each text box and label. Set the focus in the first text box.
btnExit_Click	Exit the project.

B. Code the Project

Follow the sketch in Figure 5.13 to create the form in the Visual Studio IDE. Figure 5.14 shows the completed form.

- Set the properties of each object, as you have planned above.
- Working from the pseudocode, write the code for each event procedure.
- When you complete the code, thoroughly test the project.

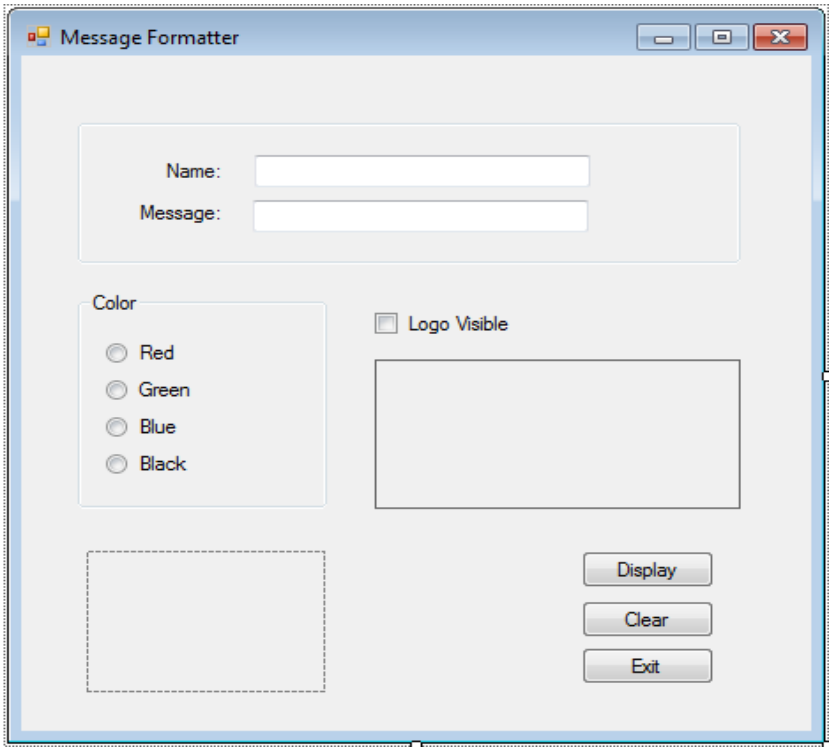


Figure 5.14 The form for the hands-on programming example.

The Project Coding Solution

```
'Project: Message Formatter
'Programmer: S. Singh
'Date: June 2014
'Description: This project displays a formatted Message

Public Class frmMain

PrivateSub btnExit_Click(ByVal sender As System.Object, ByVal e As
                                        System.EventArgs) Handles btnExit.Click
Me.Close()
EndSub
```

```
PrivateSub btnClear_Click(ByVal sender As System.Object, ByVal e As
                                        System.EventArgs) Handles btnClear.Click
        txtName.Clear()
        txtMessage.Clear()
        lblMessage.Text = ""
        chkLogoVisible.Checked = False
        picLogo.Visible = False
        optBlack.Checked = False
        optRed.Checked = False
        optGreen.Checked = False
```

```
        optBlue.Checked = False
        txtName.Focus()
EndSub
```

```
PrivateSub btnDisplay_Click(ByVal sender As System.Object, ByVal e As
                                    System.EventArgs) Handles btnDisplay.Click
        lblMessage.Text = txtMessage.Text & vbNewLine & vbNewLine &"by : "& txtName.Text
EndSub
```

```
PrivateSub chkLogoVisible_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles chkLogoVisible.CheckedChanged
        picLogo.Visible = chkLogoVisible.Checked
EndSub
```

```
PrivateSub optRed_CheckedChanged(ByVal sender As System.Object, ByVal e As
                                  System.EventArgs) Handles optRed.CheckedChanged
        lblMessage.ForeColor = Color.Red
EndSub
```

```
PrivateSub optGreen_CheckedChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles optGreen.CheckedChanged
        lblMessage.ForeColor = Color.Green
EndSub
```

```
PrivateSub optBlue_CheckedChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles optBlue.CheckedChanged
        lblMessage.ForeColor = Color.Blue
EndSub
```

```
PrivateSub optBlack_CheckedChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles optBlack.CheckedChanged
        lblMessage.ForeColor = Color.Black
EndSub

EndClass
```

5.6 Introduction to Variables and Data Types

So far, all data you have used in your projects have been properties of objects. Visual Basic allows you to set up locations in memory and give each location a name. You can visualize each memory location as a scratch pad; the contents of the scratch pad can change as the need arises. In this example, the memory location is called *MaximumInteger*.

```
MaximumInteger = 100
```

MaximumInteger
100

Memory locations that hold data that can be changed during project execution are called *variables*; locations that hold data that cannot change during execution are called ***constants***. For example, the customer's name will vary as the information for each individual is processed. However, the name of the company and the sales tax rate will remain the same (at least for that day).

When you declare a variable or a **named constant**, Visual Basic reserves an area of memory and assigns it a name, called an ***identifier***. You specify identifier names according to the rules of Basic as well as some recommended naming conventions.

The **declaration** statements establish your project's variables and constants, give them names, and specify the type of data they will hold. Here are some sample declaration statements:

```
' Declare a string variable.
Dim NameString As String
' Declare integer variables.
Dim CounterInteger As Integer
Dim MaxInteger As Integer = 100
' Declare a named constant.
Const DISCOUNT_RATE_Decimal As Decimal = 0.15D
```

5.6.1 Data Types

The **data type** of a variable or constant indicates what type of information will be stored in the allocated memory space: perhaps a name, a dollar amount, a date, or a total. The data types in VB are referred to as classes, and the variables are objects of the class.

VB Data Type	Use For	Storage Size in bytes
Boolean	True or False values	2
Byte	0 to 255, binary data	1
Char	Single Unicode character	2
Date	1/1/0001 through 12/31/9999	8
Decimal	Decimal fractions, such as dollars and cents	16
Single	Single-precision floating-point numbers with six digits of accuracy	4
Double	Double-precision floating-point numbers with 14 digits of accuracy	8
Short	Small integer in the range −32,768 to 32,767	2
Integer	Whole numbers in the range −2,147,483,648 to +2,147,483,647	4
Long	Larger whole numbers	8
String	Alphanumeric data: letters, digits, and other characters	Varies
Object	Any type of data	4

Figure 5.15 The Visual Basic Data Types

5.6.2 Variable Naming Conventions

A programmer has to name (identify) the variables and named constants that will be used in a project. Visual Basic requires identifiers for variables and named constants to follow these rules: names may consist of letters, digits, and underscores; they must begin with a letter; they cannot contain any spaces or periods; and they may not be reserved words. (Reserved words, also called *keywords*, are words to which Basic has assigned some meaning, such as *print*, *name*, and *value*.) In addition, you *should* follow some naming conventions. The following conventions are widely used in the programming industry:

1. *Identifiers must be meaningful*. Choose a name that clearly indicates its purpose. Do not abbreviate unless the meaning is obvious and do not use very short identifiers, such as *X* or *Y*.
2. *Include the class (data type) of the variable*.
3. Begin with the data type and then capitalize each successive word of the name. Always use mixed case for variables; uppercase for constants.

Example:

```
Dim intAge As Integer' to store age
Dim strFirstName As String' to store FirstName
Dim dblAvgMark As Double' to store average mark

Const dblDISCOUNT_RATE As Decimal = 0.15D ' to store Constant Rate
```

5.6.3 Scope and Lifetime of Variables

A variable may exist and be visible for an entire project, for only one form, or for only one procedure. The visibility of a variable is referred to as its **scope**. **Module-level variables**, also called **class-level variables**, are accessible from all procedures of a form. A **local variable** may be used only within the procedure in which it is declared, and a **block-level variable** is used only within a block of code inside a procedure. You declare the scope of a variable by choosing where to place the declaration statement.

Note: Previous versions of VB and some other programming languages refer to namespace variables as *global variables*

The lifetime of a module-level variable is the entire time the form is loaded, generally the lifetime of the entire project. If you want to maintain the value of a variable for multiple executions of a procedure—for example, to calculate a running total—you must use a module-level variable (or a variable declared as Static)

a. Local Declarations

Any variable that you declare inside a procedure is local in scope, which means that it is known only to that procedure. Use the keyword Dim for local declarations. A Dim statement may appear anywhere inside the procedure as long as it appears prior to the first use of the variable in a statement. However, good programming practices dictate that Dims should appear at the top of the procedure, prior to all other code statements (after the remarks).

b. Module-Level Declarations

At times you need to be able to use a variable or constant in more than one procedure of a form. When you declare a variable or constant as module level, you can use it anywhere in that form. When you write module-level declarations, you can use the Dim, Public, or Private keyword. The preferred practice is to use either the Public or Private keyword for module-level variables rather than Dim.

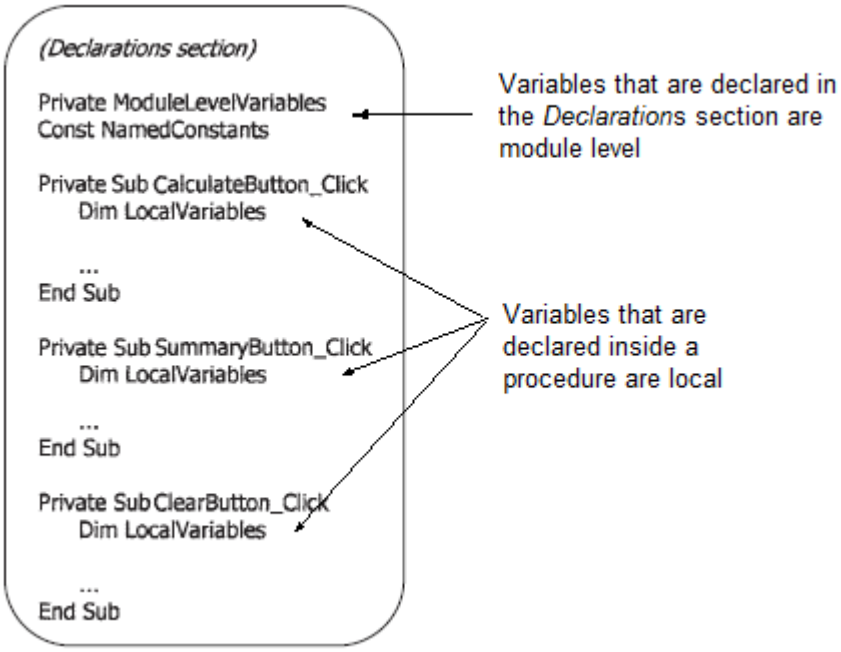


Figure 5.16 illustrates the locations for coding local variables and module level variables.

5.6.4 Visual Basic Statements and Expressions

The simplest statement is the **assignment** statement. It consists of a variable name, followed by the assignment operator (=), followed by some sort of **expression**.

Examples:

```
lblMessage.Text= "Bula Captain Tawake"
intCount = intCount + 1
Energy = Mass * LIGHTSPEED ^ 2
NetWorth = Assets – Liabilities
```

The assignment statement stores information. Statements normally take up a single line with no terminator. Statements can be **stacked** by using a colon (**:**) to separate them. Example

StartTime = Now :EndTime = StartTime + 10

(Be careful stacking statements, especially with If/End If structures. You may not get the response you desire.)

If a statement is very long, it may be continued to the next line using the **continuation** character, an underscore (_).

Example:

```
Months = Log(Final * IntRate / Deposit + 1) _
/ Log(1 + IntRate)
```

Comment statements begin with the keyword **Rem** or a single quote ('). For example:

```
Rem This is a remark
' This is also a remark
x = 2 * y ' another way to write a remark or comment
```

You, as a programmer, should decide how much to comment your code. Consider such factors as reuse, your audience, and the legacy of your code.

5.6.5 Visual Basic Operators

The simplest **operators** carry out **arithmetic** operations. These operators in their order of precedence are:

Operator	Operation
^	Exponentiation
* /	Multiplication and division
\	Integer division (truncates)
Mod	Modulus
+ -	Addition and subtraction

Parentheses around expressions can change the precedence.

To **concatenate** two strings, we can use the **&** symbol or the **+** symbol:

```
lblTime.Caption = "The current time is" &Format(Now, “hh:mm”)
txtSample.Text = "Hook this “ + “to this”
```

There are six **comparison** operators in Visual Basic:

Operator	Comparison
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
=	Equal to
<>	Not equal to

The result of a comparison operation is a Boolean value (**True** or **False**).

Logical Operators

We will use three **logical** operators

Operator	Operation
Not	Logical not
And	Logical and
Or	Logical or

The **Not** operator simply negates an operand. The **And** operator returns a True if both operands are True. Else, it returns a False. The **Or** operator returns a True if either of its operands is True, else it returns False. Logical operators follow arithmetic operators in precedence.

5.6.6 Visual Basic Functions

Visual Basic offers a rich assortment of built-in **functions**. The on-line help utility will give you information on any or all of these functions and their use. Some examples are:

Function	Value Returned
Abs	Absolute value of a number
Asc	ASCII or ANSI code of a character
Chr	Character corresponding to a given ASCII or ANSI code
Cos	Cosine of an angle
Date	Current date as a text string
Format	Date or number converted to a text string
Left	Selected left side of a text string
Len	Number of characters in a text string
Mid	Selected portion of a text string
Now	Current time and date
Parse	convert value to another format
Right	Selected right end of a text string
Rnd	Random number
Sin	Sine of an angle
Sqr	Square root of a number
Str	Number converted to a text string
Time	Current time as a text string
Timer	Number of seconds elapsed since midnight
ToString	Converts to String
Val	Numeric value of a given text string

Explicit conversion, also called ***casting:***

```
NumberDecimal = Convert.ToDecimal(NumberSingle)
ValueInteger = Convert.ToInt32(ValueDouble)
AmountSingle = Convert.ToSingle(AmountDecimal)
```

Review Exercise 5.6

Short Answer Questions

a) Write a declaration using the Dim statement for the following situations; makeup an appropriate variable identifier.
    1) You need variables for payroll processing to store the following:
        - Number of hours, which can hold a decimal value.
        - Employee's name.
        - Department number (not used in calculations).
    2) You need variables for inventory control to store the following:
        - Integer quantity.
        - Description of the item.
        - Part number.
        - Cost.
        - Selling price.

b) Explain the difference between a constant and a variable.

c) What will be the result of the following calculations using the order of precedence? Assume that: intFirst = 2, intSecond = 4, intThird = 3
    a) intFirst + intSecond ^ 2
    b) 8 / intSecond / intFirst
    c) intFirst * (intFirst + 1)
    d) intFirst * intFirst + 1
    e) intSecond ^ intFirst + intThird * 2
    f) intSecond ^ (intFirst + intThird) * 2
    g) (intSecond ^ intFirst) + intThird * 2
    h) ((intSecond ^ intFirst) + intThird) * 2

5.7 Trying a Hands-on Programming Example (Price Calculator)

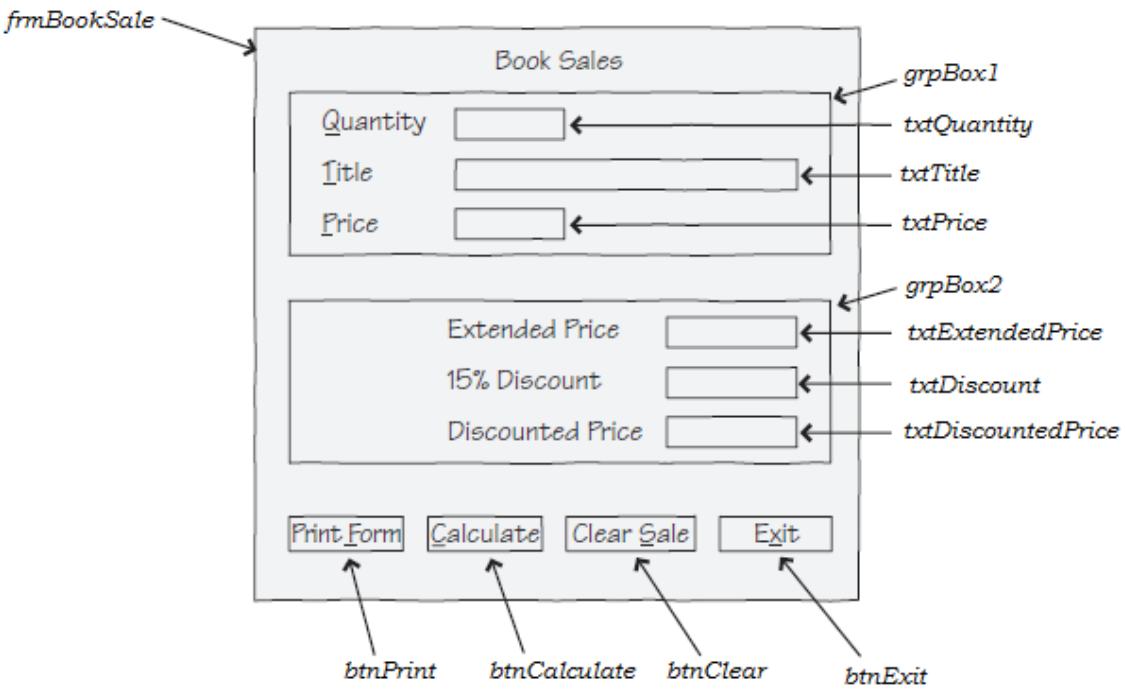
Program Specification:

Suva Book Shop needs to calculate prices and discounts for books sold. The company is currently having a big sale, offering a 15 percent discount on all books.

In this project you will calculate the amount due for a quantity of books, determine the 15 percent discount, and deduct the discount, giving the discounted amount. Use text boxes with the Read Only property set to True for the output fields.

A. Planning the Project

Sketch a form that meets the needs of the users.



Plan the Objects and Properties

Plan the property settings for the form and each of the controls.

Objects	Property	Settings

Form1	Name	frmBookSale
	Text	Suva Book Shop
	AcceptButton	btnCalculate
	CancelButton	btnClear
Label1	Text	Book Sales
	Font	Bold, 12 point
GroupBox1	Name	grpBox1
	Text	(empty)
Label2	Text	&Quantity
QuantityTextBox	Name	txtQuantity
	Text	(blank)
Label3	Text	&Title
TitleTextBox	Name	txtTitle
	Text	(blank)
Label4	Text	&Price
PriceTextBox	Name	txtPrice
	Text	(blank)
GroupBox2	Name	grpBox2
	Text	(blank)
Label5	Text	ExtendedPrice
ExtendedPriceTextBox	Name	txtExtendedPrice
	TextAlign	Right
	ReadOnly	True
	TabStop	False
Label6	Text	15% Discoun
DiscountTextBox	Name	txtDiscount
	TextAlign	Right
	ReadOnly	True
	TabStop	False
Label7	Text	Discounted Price
DiscountedPriceTextBox	Name	txtDiscountedPrice
	TextAlign	Right
	ReadOnly	True
	TabStop	False

Plan the Event Procedures

Since you have four buttons, you need to plan the actions for four event procedures.

Event Procedure	Actions - Pseudocode
btnPrint_Click	Set the print action to preview. Print the form.
btnCalculate_Click	Declare the variables. Convert the input Quantity and Price to numeric. Calculate Extended Price = Quantity * Price. Calculate and round: Discount = Extended Price * Discount Rate. Calculate Discounted Price = Extended Price – Discount. Format and display the output in text boxes.
btnClear_Click	Clear each text box. Set the focus in the first text box.
btnExit_Click	Exit the project.

B. Write the Project

Follow the sketch produced in part A, create the form. Figure 5.17 shows the completed form.

1. Set the properties of each object, as you have planned.
2. Write the code. Working from the pseudocode, write each event procedure.
3. When you complete the code, use a variety of test data to thoroughly test the project.

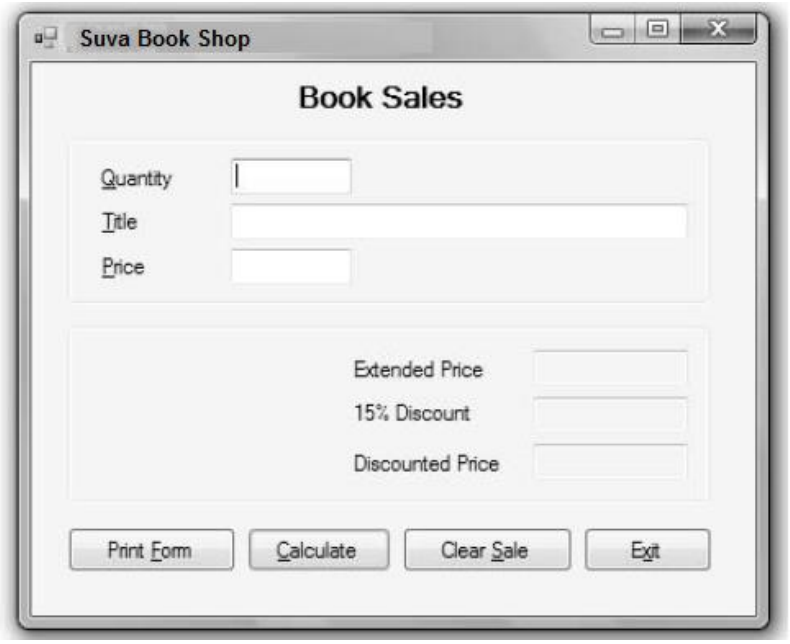


Figure 5.17 The form for the calculation programming example

Note: If the user enters nonnumeric data or leaves a numeric field blank, the program will cancel with a run-time error. In the "Handling Exceptions" section that follows this program, you will learn to handle the errors.

The Project Coding Solution

```
'Project: Suva Book Shop
'Date: June 2014
'Programmer: S. Singh
'Description: This project inputs sales information for books.
' It calculates the extended price and discount for
' a sale. Uses variables, constants, and calculations.
' Note that no error trapping is included in this version of the program.

PublicClass frm BookSale
' Declare the constant.
Const DISCOUNT_RATE_Decimal AsDecimal = 0.15D
PrivateSub btnPrint_Click(ByVal sender As System.Object, _
                          ByVal e As System.EventArgs) Handles btnPrint.Click
' Print the form.
        PrintForm1.PrintAction = Printing.PrintAction.PrintToPreview
        PrintForm1.Print()
EndSub
```

```
PrivateSub btnCalculate_Click(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles btnCalculate.Click
```

```
' Calculate the price and discount.
Dim QuantityInteger AsInteger
Dim PriceDecimal, ExtendedPriceDecimal, DiscountDecimal, _
        DiscountedPriceDecimal AsDecimal
' Convert input values to numeric variables.
        QuantityInteger = Integer.Parse(txtQuantity.Text)
        PriceDecimal = Decimal.Parse(txtPrice.Text)
' Calculate values.
        ExtendedPriceDecimal = QuantityInteger * PriceDecimal
        DiscountDecimal = Decimal.Round( _
        (ExtendedPriceDecimal * DISCOUNT_RATE_Decimal), 2)
        DiscountedPriceDecimal = ExtendedPriceDecimal - DiscountDecimal
' Format and display answers.
        txtExtendedPrice.Text = ExtendedPriceDecimal.ToString("C")
        txtDiscount.Text = DiscountDecimal.ToString("N")
        txtDiscountedPrice.Text = DiscountedPriceDecimal.ToString("C")
EndSub
```

```
PrivateSub ClearButton_Click(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles clearButton.Click
' Clear previous amounts from the form.
        txtTitle.Clear()
        txtPrice.Clear()
        txtExtendedPrice.Clear()
        txtDiscount.Clear()
        txtDiscountedPrice.Clear()
With txtQuantity
            .Clear()
            .Focus()
EndWith
EndSub
```

```
PrivateSub btnExit_Click(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles btnExit.Click
' Exit the project.
Me.Close()
EndSub
```

Review Exercise 5.7

Short Answer Questions

a) What are implicit conversions? explicit conversions? When would each beused?

b) Explain the purpose of the following line of code:

```
With txtQuantity
    .Clear()
    .Focus()
EndWith
```

c) Draw the flowchart for the btn_Calculate_Click()for the price calculator example above.

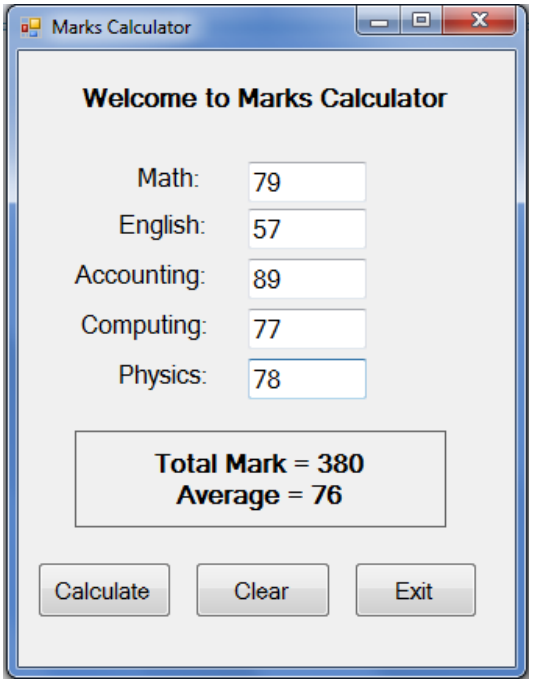
Practical Task

1. Create a project that calculates the total of fat, carbohydrate, and protein calories. Allow the user to enter (in textboxes) the grams of fat, the grams of carbohydrates, and the grams of protein. Each gram of fat is nine calories; a gram of protein or carbohydrate is four calories. Display the total calories for the current food item in a label.

   Form: The form should have three text boxes for the user to enter the grams for each category. Include labels next to each text box indicating what the user is to enter. Include buttons to *Calculate*, to *Clear* the text boxes, and to *Exit*. Make the form's Text property "Calorie Counter".

   a. Sketch the User Interface (provide appropriate names for the controls)
   b. State the properties of the objects (tabular format)
   c. Draw a flowchart for *btnCalculate*
   d. Design the form using the VB IDE
   e. Code the project

2. Create a project that calculates the total and average mark for five (five). Allow the user to enter 5 marks (English, Math, Accounting, Computing, and Physics) in the respective textboxes. The program should display the Total Mark and Average Mark for the five subjects in a label. The snapshot for the user interface is provided below:



5.8 Decision Structures (IF Then ELSE Statements)

A powerful capability of the computer is its ability to make decisions and to take alternate courses of action based on the outcome. A decision made by the computer is formed as a question:

Is a given condition true or false? If it is true, do one thing; if it is false, do something else.

Example:

If *the sun is shining* Then (condition)
    go to the beach (action to take if condition is true)
Else
    go to class (action to take if condition is false)
End If

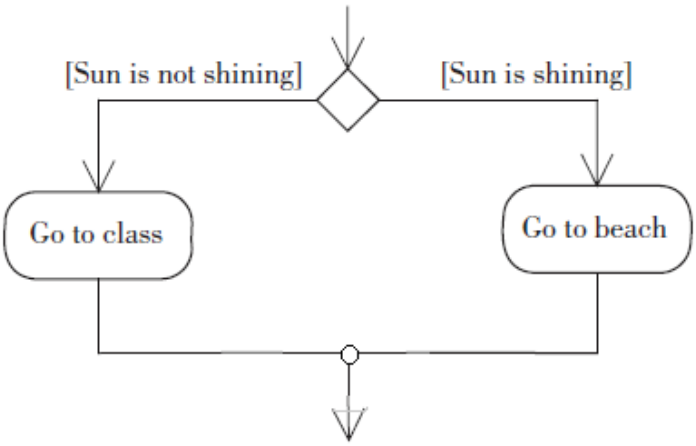


Figure 5.18 The logic of an If / Then / Else statement

A block **If / Then / Else** must always conclude with **End If**. The word Then must appear on the same line as the If with nothing following Then (except a remark). End If and Else (if used) must appear alone on a line. The statements under the Then and Else clauses are indented for readability and clarity.

Example 1:

```
If blnSunny = vbTrueThen
lblMessage.Text = "Go to Beach"
Else
lblMessge.Text = "Go to Class"
EndIf
```

Example 2:

```
dblSpeed =    Double.Parse(txtSpeed.Text)
If dblSpeed > 80 Then
MessageBox.Show("Fine is $50")
Else
     MessageBox.Show("Driving within Speed Limit")
EndIf
```

The General Form - **If / Then / Else Statement**

If (*condition*) **Then**
statement(s)
[**ElseIf** (*condition*) **Then**
statement(s)]
[**Else**
statements(s)]

```
End If
```

5.8.1 Boolean Expressions

The test in an If statement is a Boolean expression, which evaluates as True or False. To form **Boolean expressions**, also referred to as ***conditions***, you use **comparison operators** (Table 5.2), also called ***relational operators***. The comparison is evaluated and the result is either True or False.

Boolean expressions can be formed with numeric variables and constants, string variables and constants, object properties, and arithmetic expressions. However, it is important to note that comparisons must be made on like types; that is, strings can be compared only to other strings, and numeric values can be compared only to other numeric values, whether a variable, constant, property, or arithmetic expression.

Symbol	Relation	Tested Examples
>	greater than	Decimal.Parse(txtAmount.Text) >dblLimit intCorrect> 75
<	less than	Integer.Parse(txtSales.Text) < 1000 txtName.Text<strName
=	equal to	txtPassword.Text = "101"
<>	not equal to	radFreshman.Checked<> True txtName.Text<> ""
>=	greater than or equal to	Integer.Parse(txtQuantity.Text) >= 500
<=	less than or equal to	txtName1.Text <= txtName2.Text

Table 9.2 Comparison Operators

5.8.2 Comparing Uppercase and Lowercase Characters

When comparing strings, the case of the characters is important. An uppercase *Y* is not equal to a lowercase *y*. Because the user may type a name or word in uppercase, in lowercase, or as a combination of cases, we must check all possibilities. The best way is to use the **ToUpper** and **ToLower methods** of the String class, which return the uppercase or lowercase equivalent of a string, respectively.

Example:

```
TextString.ToUpper()
TextString.ToLower()
```

5.8.3 Compound Boolean Expressions

You can use **compound Boolean expressions** to test more than one condition. Logical operators can be used to combine relational expressions to test complex conditions. The three logical operators you can use are AND, OR and NOT.

The compound Boolean expression will only evaluate to true if all expressions evaluate to true. As soon as one expression evaluates to false, the entire expression will be evaluated to false.

Example 1:

```
If(intTotalMark> 350) AND (intEnglishMark>= 60) Then
    lblMessage.Text = "Scholarship Granted"
End If
```

Example 2:

```
If(intMathMark>100) OR (intMathMark< 0) Then
    lblMessage.Text = "Invalid Mark"
End If
```

Example3:

```
If(intMathMark>80) AND (optMale.Checked = True) Then
    lblMessage.Text = "Good Job Boy!"
ElseIf(intMathMark>80) AND (optFemale.Checked = True) Then
    lblMessage.Text = "Good Job Girl!"
Else
    lblMessage.Text = "Try Harder!"
End If
```

Review Exercise 5.8

Short Answer Questions

a) Draw the flowchart for the following guessing game program:

```
Dim intK as Integer
Dim intL as Integer
```

```
intK = InputBox("Guess value of K: ")
intL = InputBox("Guess value of L: ")

If (intK=1) AND (intL = 2) Then
    MessageBox.Show("Good Try! You are correct")
Else
    MessageBox.Show("Try Again!")
End If
```

b) What will the output of the program if user enters:

i. K = 5 L = 6

ii. K = 1 L = 2

c) Improve the guessing game program by declaring the values of K = 1 and L = 2 as constants. You may try implementing this program.

Practical Task

1. Write a program for Land Transport Authority - Fiji that asks the traffic officer to enter the speed of the car in a textbox and then displays the following fine messages in a label.

Car Speed	Fine Message
<= 50	There is no Fine. You are a good driver.
51-64 (inclusive)	Please slow down. Your fine is $15.00
65 – 79 (inclusive)	Your fine is $80.
>80	Your fine is $200 and your license is suspended for 1 year

2. Mere Tawake owns a Beauty Salon. Her clients can select from the following services at the specified regular prices: Makeover $125, Hair Styling $60, Manicure $35, and Permanent Makeup $200. She has distributed discount coupons that advertise discounts of 10 percent and 20 percent off the regular price. Create a project that will allow the receptionist to select a discount rate of 10 percent, 20 percent, or none, and then select a service. Display the total price for the currently selected service and the total due after considering the discount rate selected. Include buttons for *Calculate*, *Clear*, and *Exit*.

5.9 Repetition Structures (FOR…NEXT Loop, DO Loops)

Until now, there has been no way to repeat the same steps in a procedure without calling them a second time. The computer is capable of repeating a group of instructions many times without calling the procedure for each new set of data. The process of repeating a series of instructions is called *looping*. The group of repeated instructions is called a ***loop***. An **iteration** is a single execution of the statement(s) in the loop.

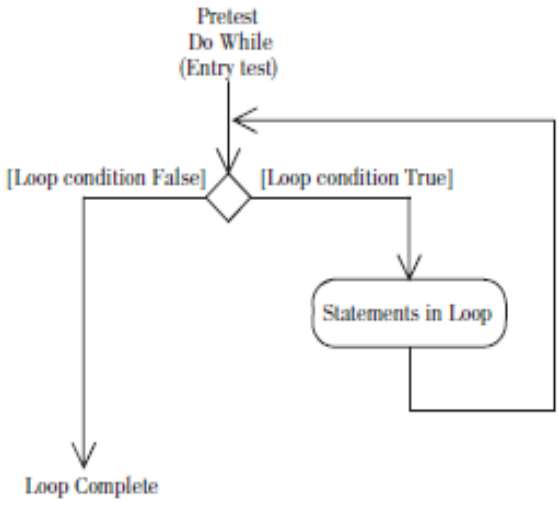
5.9.1 DO/Loop

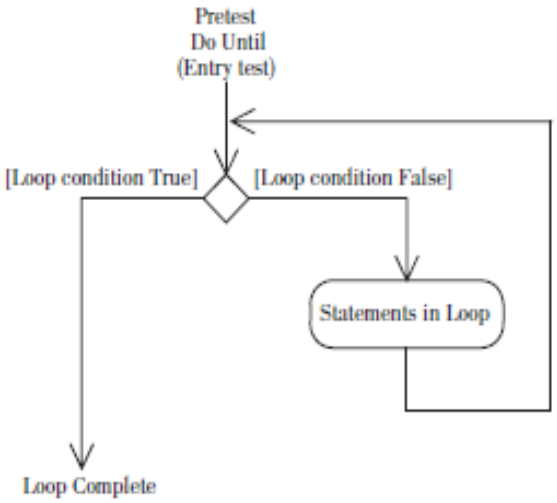
A **Do/Loop** terminates based on a condition that you specify. Execution of a Do/Loop continues *while* the condition is True or *until* the condition is True. You can choose to place the condition at the top or the bottom of the loop. Align the **Do** and **Loop statements** with each other and indent the lines of code to be repeated in between.

The Do and Loop Statements—General Form

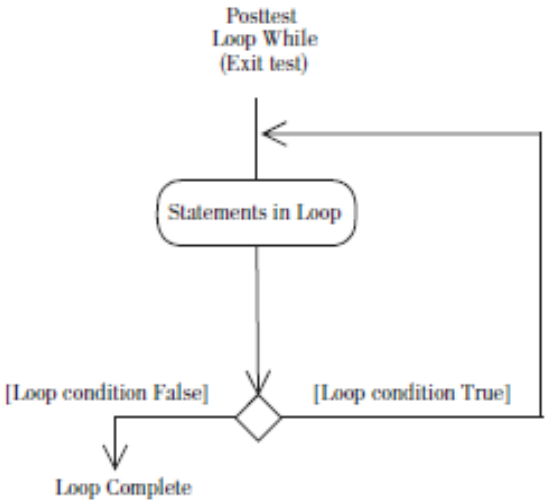
```
Do {While | Until} Condition
        ' Statements in loop.
Loop

Or

Do
        ' Statements in loop.
Loop {While | Until} Condition
```

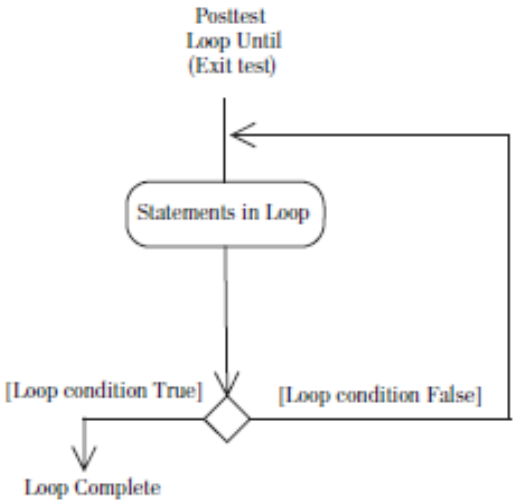
The first form of the Do/Loop tests for completion at the top of the loop. With this type of loop, also called a ***pretest*** or ***entry test***, the statements inside the loop may never be executed if the terminating condition is True the first time it is tested.





The second form of the Do/Loop tests for completion at the bottom of the loop, which means that the statements inside the loop will *always* be executed at least once. This form of loop is sometimes called a ***posttest*** or ***exit test***.





Example:

Suppose you have to print all even numbers between 2 to 20 (inclusive). The following will be your Do/Loop Structures

Solution 1 : Pretest Do/While Loop

```
Dim intNum AsInteger
intNum = 2   'intitialise starting value

DoWhile (intNum <= 20)   ' Condition
```

```
        lblAnswer.Text = lblAnswer.Text &" "& intNum ‘concatenate answer
        intNum = intNum + 2 ‘increment by 2 for even numbers
Loop
```

Solution 2 : Pretest Do/Until Loop

```
Dim intNum AsInteger
intNum = 2 ‘intitialise starting value

DoUntil (intNum > 20)   ‘ Condition
        lblAnswer.Text = lblAnswer.Text &" "& intNum
        intNum = intNum + 2   ‘increment by 2 for even numbers
Loop
```

Solution 3 : Post-test Do/Until Loop

```
Dim intNum AsInteger
intNum = 2 ‘intitialise starting value

Do
        lblAnswer.Text = lblAnswer.Text &" "& intNum
        intNum = intNum + 2   ‘increment by 2 for even numbers
LoopUntil (intNum > 20)   ‘ Condition
```

Solution 2 : Post-test Do/While Loop

```
Dim intNum AsInteger
intNum = 2 ‘intitialise starting value

Do
      lblAnswer.Text = lblAnswer.Text &" "& intNum
      intNum = intNum + 2    ‘increment by 2 for even numbers
LoopWhile (intNum <= 20)   ‘ Condition
```

Note that all the iteration structures have the **initialization** step, a **condition** and an **increment** operator to ensure that the Loop executes correctly.

5.9.2 For/Next Loops

When you want to repeat the statements in a loop a specific number of times, the **For/Next loop** is ideal. The For/Next loop uses the **For** and **Next statements** and a counter variable, called the ***loop index***. The

loop index is tested to determine the number of times the statements inside the loop will execute.

The For and Next Statements—General Form

```
For LoopIndex[As Datatype] = InitialValueToTestValue[Step Increment]
'
' Statements in loop.
'
Next [LoopIndex]
```

The For and Next Statements—Example

To demonstrate how the For/Next Loop operates, we will use the same example of printing even numbers between 2 to 20 (inclusive)

```
Dim intNum AsInteger

For intNum = 2 To 20 Step 2 ‘initialisation/increment/condition
    lblAnswer.Text = lblAnswer.Text &" "& intNum
Next intNum
```

LoopIndex must be a numeric variable; *InitialValue* and *TestValue* may be constants, variables, numeric property values, or numeric expressions. The optional word Step may be included, along with the value to be added to the loop index for each iteration of the loop. When the Step is omitted, the increment is assumed to be 1. You can use a negative number for the Step increment to decrease the loop index rather than increase it. For instance, if you want to display even numbers in descending order, the following will be the code.

Example:

```
Dim intNum AsInteger

For intNum = 20 To 2 Step -2
        lblAnswer.Text = lblAnswer.Text &" "& intNum
Next intNum
```

5.9.3 Exiting Loops

Usually loops should proceed to normal completion. However, on occasion you may need to terminate a loop before the loop index reaches its final value. Visual Basic provides Exit For and Exit Do statements for this situation. Generally, the Exit statement is part of an If statement.

The Exit For and Exit Do transfer control to the statement following the loop termination—the Next or Loop statement at the bottom of the loop structure.

Review Exercise 5.9

Short Answer Questions

a) In what situation would a loop be used in a procedure?
b) Explain the difference between a pretest and a post-test in a Do/Loop.
c) Explain the differences between a Do/Loop and a For/Next loop.
d) What are the steps in processing a For/Next loop?

Practical Task

---

1. Write an application that displays all the numbers from 1 to 20 (inclusive) in ascending order. Use the three different loop structures: FOR/NEXT, DO UNTIL and DO/WHILE Loop.
2. Write an application that displays all the numbers from 1 to 20 (inclusive) in descending order. Use the three different loop structures: FOR/NEXT, DO UNTIL and DO/WHILE Loop.
3. Write an application that displays the first 10 multiples of 5. Use the three different loop structures FOR/NEXT, DO UNTIL and DO/WHILE Loop.
4. Write different VB application (in each case) that accepts a number N from the user and does the following:
    a. Computes N Factorial (N! = N x (N-1) x (N-2) x …x 3 x 2 x 1)
    b. Sum of all the values from 1 to N
    c. Displays a message stating whether the number N is positive or negative
    d. Displays whether the number N is odd or even.
5. Write VB programs to generate the following patterns :

a.)
```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

b.)
```
1 2 3 4 5
1 2 3 4
1 2 3
1 2
1
```

5.10 Writing General Procedures

Often you will encounter programming situations in which multiple procedures perform the same operation. This condition can occur when the user can select either a button or a menu item to do the same thing. Rather than retyping the code, you can write reusable code in a **general procedure** and call it from both event procedures.

General procedures are also useful in breaking down large sections of code into smaller units that perform a specific task. By breaking down your calculations into smaller tasks, you simplify any maintenance that needs to be done in a program in the future.

You can choose from two types of general procedures: **sub procedures** and **function procedures**:

- A sub procedure performs actions.
- A function procedure performs actions and returns a value (the **returnvalue**).

You will likely use a sub procedure if you need to set property values for a series of objects. However, if you need to calculate a result, then a function procedure is the appropriate choice. Both sub procedures and function procedures are considered the **methods** of object-oriented programming.

5.10.1 Creating a New Sub Procedure

You can create a sub procedure in the Editor window by enclosing the desired lines of code within a set of Sub and End Sub statements.

Sub...End Sub Statements—General Form

```
Private Sub ProcedureName()
'... Statements in the procedure.
End Sub
```

For example, if you want to create a procedure to clear the Mainform:

Sub...End Sub Statements—Example

```
Private Sub ClearAll()
        txtFirstName.Text = “”
        txtLastName.Text = “”
        txtCountry.Text = “”
        lblMessage.Text = “”
        chkFlagVisible.checked = False
```

```
        optMale.checked = False
        optFemale.checked = False
        txtFirstName.Focus
End Sub
```

Passing Arguments to a Procedure

At times you may need to use the value of a variable in one procedure and then again in a second procedure that is called from the first. In this situation, you could declare the variable as module level, but that approach makes the variable visible to all other procedures. To keep the scope of a variable as narrow as possible, consider declaring the variable as local and passing it to any called procedures.

As an example, we will pass the age to the Display() procedure.

Example to Display Age using a procedure call

```
‘ Display Procedure accepting a value
PrivateSub Display(ByVal intAge AsInteger)
        MessageBox.Show("Your Age is : "& intAge)
EndSub

‘ Calling the Display Procedure

PrivateSub btnPushMe_Click(ByVal sender As System.Object, ByVal e As
                                System.EventArgs) Handles btnPushMe.Click
Dim intAge AsInteger
         intAge = 17
         Display(intAge)
EndSub
```

Passing Arguments ByVal or ByRef

When you pass an argument to a procedure, you may pass it **ByVal** or **ByRef** (for *by value* or *by reference*). ByVal sends a copy of the argument’s value to the procedure so that the procedure cannot alter the original value. ByRef sends a reference indicating where the value is stored in memory, allowing the called procedure to actually change the argument’s original value. You can specify how you want to pass the argument by using the ByVal or By Ref keyword before the parameter in the procedure header. If you don’t specify ByVal or ByRef, arguments are passed by value.

5.10.2 Writing Function Procedures

As a programmer, you may need to calculate a value that will be needed in several different procedures or programs. You can write your own function that will calculate a value and call the function from the locations where it is needed. As an example, we will create a function procedure called *Commission* that calculates and returns a salesperson's commission.

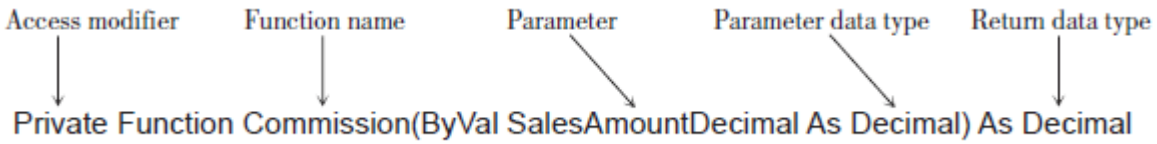


Figure 9.27 Procedure header for a Function Header

Notice that this procedure looks just like a sub procedure except that the word *Function* replaces the word *Sub* on both the first line and the last line. The procedure header also includes a data type, which is the type of the value returned by the function.

The main difference between coding a function procedure and coding a sub procedure is that in a function procedure you must set up the return value. This return value is placed in a variable that Visual Basic names with the same name as the function name.

Writing a Commission Function

Here is the *Commission* function procedure coded using the first technique for returning a value.

```
PrivateFunction Commission(ByVal dblSalesAmount AsDouble) As
Decimal

Dim dblAnswer AsDouble
' Calculate the sales commission.
If dblSalesAmount < 1000D Then
        dblAnswer = 0D
ElseIf dblSalesAmount <= 2000D Then
        dblAnswer = 0.15D * dblSalesAmount
Else
        dblAnswer = 0.2D * dblSalesAmount
EndIf

Return dblAnswer

End Function
```

Calling the Commission Function

In another procedure in the form, you can call your function by using it in an expression.

```
PrivateSub btnCalculate_Click(ByVal sender As System.Object, ByVal e As
                              System.EventArgs) Handles CalculateButton.Click
' Calculate the commission.
Dim dblSales AsDouble
    dblSales = Decimal.Parse(txtSales.Text)
    lblCommission.Text = Commission(dblSales).ToString("C")
EndSub
```

A function can have multiple parameters. The sequence and data type of the arguments in the call must exactly match the parameters in the function procedure header. Each argument has to be separated by a comma ‘,’.

Review Exercise 5.10

Practical Task

1. Write a VB application that accepts two numbers (decimal) from the user via different textboxes (*txtNum1, txtNum2*) and computes their sum, difference and product. The results are displayed in a label (lblAnswer) when the corresponding button (*btnSum, btnDifference, btnProduct*) is clicked. The application should also have a *Clear* and *Exit* button.
    a. Design the User Interface
    b. Write a procedure to clear the two textboxes and the label. Call the procedure in *btnClear.*
    c. Write a function Sum() that accepts two decimal numbers and returns their sum
    d. Write a function Difference() that accepts two decimal numbers and returns their difference
    e. Write a function Product() that accepts two decimal numbers and returns their product
    f. Call the above functions in the respective button events and display their results in the *lblAnswer.*

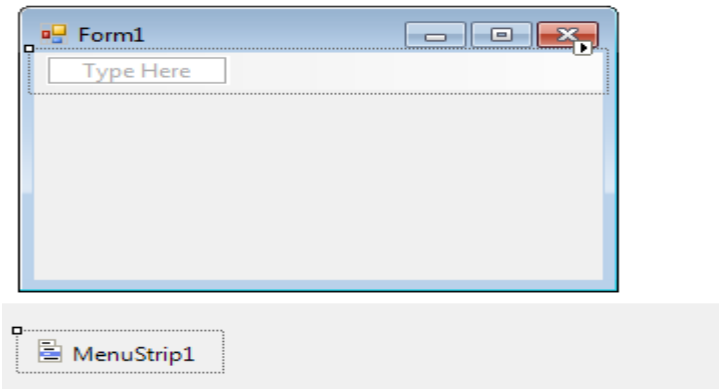
5.11 Menus

You have undoubtedly used menus quite extensively while working with the computer. **Menus** consist of a menu bar that contains menus, each of which drops down to display a list of menu items. You can use menu items in place of or in addition to buttons to execute a procedure.

Menu items are actually controls; they have properties and events. Each menu item has a Name property, a Text property, and a Click event, similar to a button. When the user selects a menu item, with either the mouse or the keyboard, the menu item's Click event procedure executes.

Adding a Menu

You must add a MenuStrip component from the *Menus & Toolbar* tab of the toolbox (Figure 5.1), which appears in the component tray below theform.



Once you have added the MenuStrip component, it is extremely easy to create the menu items for your menu. The words *Type Here* appear at the top of the form, so that you can enter the text for your first menu (Figure 5.2). After you type the text for the first menu name and press Enter, the words *Type Here* appear both below the menu name and to the right of the menu name. You can choose next to enter menu items for the first menu or to type the words for the second menu (Figure 5.3). Each time you type the text for a new menu, you are automatically adding a ToolStripMenuItem to the MenuStrip's Items collection.

Note: If you click elsewhere on the form, you deactivate the Menu Designer. You can click on the menu at the top of the form or on the MenuStrip component to activate the Menu Designer again.

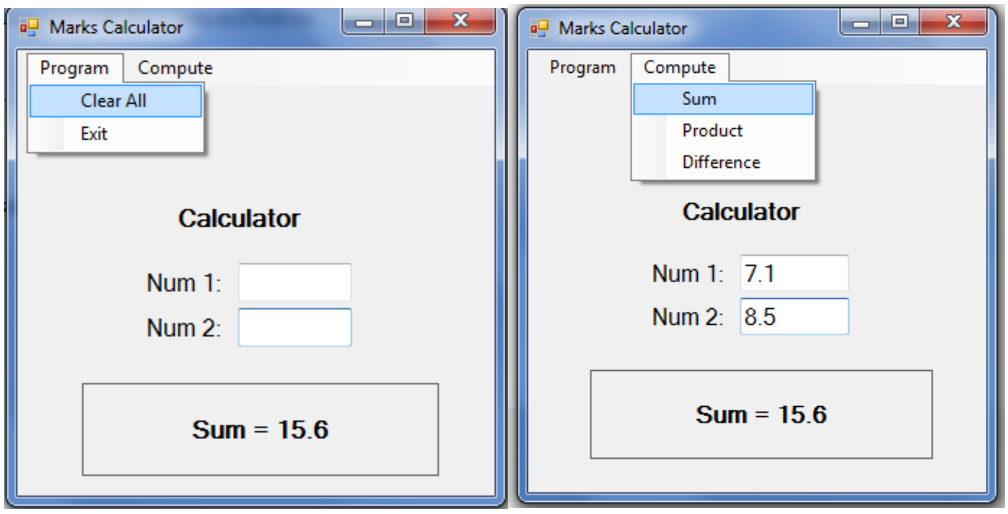
You can enter and change the Text and Name property for each of your menus and menu items using the Menu Designer. You also can change the Text property using the Properties window.

You can double-click on the menu items and code them just like you code the command buttons.

Review Exercise 5.11

Practical Task

1. Replace the Command Buttons from Practical Task 1 in Section 5.13 with Menu Options. A snapshot has been provided below on the new user interface for the program.



5.12 Finding and Fixing Errors

You already may have seen some errors while running your VB applications. Programming errors come in three varieties: **syntax errors**, **run-time errors**, and **logic errors**.

5.12.1 Syntax Errors

When you break VB's rules for punctuation, format, or spelling, you generate a syntax error. Fortunately, the smart editor finds most syntax errors and even corrects many of them for you. The syntax errors that the editor cannot identify are found and reported by the compiler as it attempts to convert the code into intermediate machine language. A compiler-reported syntax error may be referred to as a *compile error*.

A blue squiggly line appears under the part of the line that the editor cannot interpret. You can view the error message by pausing the mouse pointer over the error, which pops up a box that describes the error (Figure 5.19).

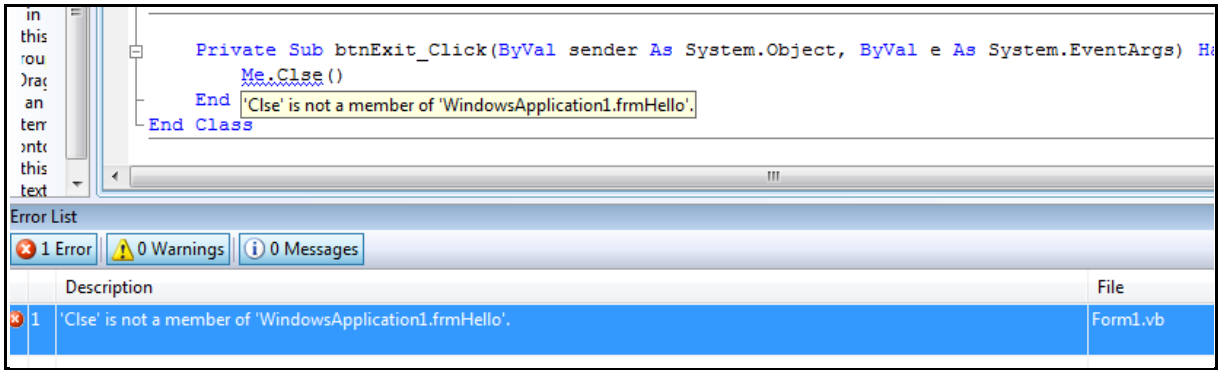


Figure 5.19 Error Debugging

The error is also displayed in the Error List window (*View / Error List*), which appears at the bottom of the Editor window and shows all error messages along with the line number of the statement that caused the error.

If a syntax error is found by the compiler, return to the editor, correct your errors, and run/build the program again.

5.12.2 Run-Time Errors

If the project halts during execution, it is called a *run-time error* or an *exception*. Visual Basic displays a dialog box and highlights the statement causing the problem. Statements that cannot execute correctly cause run-time errors. The statements are correctly formed Basic statements that pass the syntax checking; however, the statements fail to execute due to some serious issue.

These can be caused by impossible arithmetic operations, such as calculate with nonnumeric data, divide by zero, or find the square root of a negative number or attempting to read a file which does not exist or has been deleted.

5.12.3 Logic Errors

When your program contains logic errors, your project runs but produces incorrect results. Perhaps the results of a calculation are incorrect or the wrong text appears or the text is okay but appears in the wrong location. Beginning programmers often overlook their logic errors. If the project runs, it must be right—right? All too often, that statement is not correct. You may need to use a calculator to check the output. Check all aspects of the project output: computations, text, and spacing.

5.12.4 Project Debugging

If you talk to any computer programmer, you will learn that programs don't have errors, but that programs get "bugs" in them. Finding and fixing these bugs is called ***debugging***.

For syntax errors and run-time errors, your job is easier. Visual Basic displays the Editor window with the offending line highlighted. However, you must identify and locate logic errors yourself.

Visual Studio has a very popular feature: edit-and-continue. If you are able to identify the run-time error and fix it, you can continue project execution from that location by clicking on the *Start Debugging* button, pressing F5, or choosing *Debug / Start Debugging*. You also can correct the error and restart from the beginning.

5.12.5 A Clean Compile

When you start executing your program, the first step is called *compiling*, which means that the VB statements are converted to Microsoft Intermediate Language (MSIL). Your goal is to have no errors during the compile process: a **clean compile**. Figure 5.20 shows the Error List window for a clean compile: 0 Errors; 0 Warnings; 0 Messages.

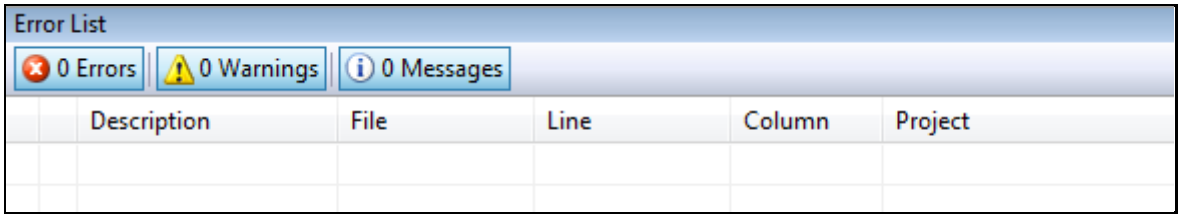


Figure 5.20 Zero errors, warnings, and messages means that you have a clean compile.

5.12.6 Managing Windows

At times you may have more windows and tabs open than you want. You can hide or close any window, or switch to a different window. You may also have to switch between the *code* and *design* window regularly.

To close a window that is a part of a tabbed window, click the window's Close button. Only the top window will close. To switch to another window that is part of a tabbed window, click on the appropriate tab.

Review Exercise 5.12

Short Answer Questions

a) What is meant by the term *debugging*?

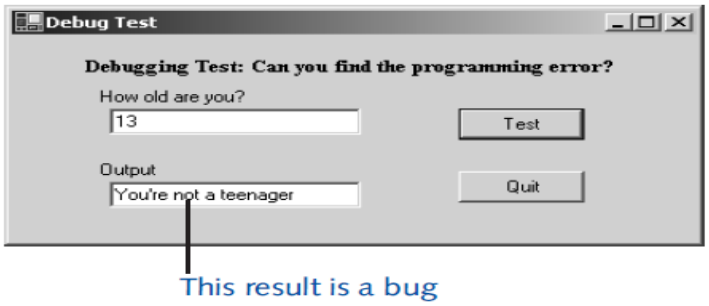
b) What is a syntax error, when does it occur, and what might cause it?

c) What is a run-time error, when does it occur, and what might cause it?

d) What is the error in the following line of code? What type of error is it?

lblMessage.txt = "Welcome to Fiji"

e) What would have been the error in the following program? What type of error is it?



(Hint: The structure fails to identify the person who is exactly 13)

Additional Review Questions

1. The following code attempts to count how many even numbers there are between *m* and *n* inclusive.

```
evens = 1
For  i = m to n Step 2
evens = evens + 1
Next i
lblCount.text = evens.toString()
```

   a) What will be the output of the above program if m = 2 and n = 34?

   b) How many times will the loop be executed?

   c) Implement the above code using a do..while and do..until loop structure.

2. Declare an appropriate variable to store your FirstName.
3. What is the result of the following code?

```
Dim Boy as string = "Jack"
Dim Girl as string = "Jill"
txtBox.Text = Boy & " and " & "Girl" & " went up the hill"
```

4. Simplify the code.

```
If (a < b) Then
      If (b < c) Then
            txtOutput.Text = b & " is between " & a & " and " & c
      End If
End If
```

5. Write the relevant code to generate all the natural no's from 20 to 50. Declare all related variables.
6. The price of a plane ticket is 1000$ by default, but a discount of 20% is applied to students. Draw a flowchart of your algorithm that solves the following problem and calculates the final price.
7. Write a function that squares and returns and integer value passed as a parameter.
8. Write the appropriate procedure that takes 2 numbers (integers) as input and calculates and displays the average and displays it in a label (use your own variable names).
9. You have been tasked to create a small application to calculate the air-fare of an individual travelling from Nadi to Savusavu based on the following requirements:

AIR VITI PRICE-LIST

Seat Price
- Adult: $79.50
- Child: $59.25

Luggage
- 1 bag : $25.00
- More than 1 bags: $40.00

The user should select either adult or child fare option and enter the *number_of_bags* they will carry in a textbox. Upon clicking the calculate button, the total fare should be displayed in a label.

a) Draw and appropriate user interface for this application

b) Code writing:

i. Declare two constants to store adult and child fare.

ii. Declare the appropriate variables and write the lines of code that will read the *number_of _bags* from the textbox and convert and store it in an integer variable. (Hint: use the Val() function)

iii. Use the if ..else structure determine the fare option selected and calculate the total fare.

iv. Write the code to display the total fare in a label (formatted as a currency)

5.13 Summary

1. Visual Basic is an object-oriented language primarily used to write application programs that run in Windows or on the Internet using a graphical user interface (GUI).
2. The .NET Framework provides an environment for the objects from many languages to interoperate. Each language compiles to Microsoft Intermediate Language (MSIL) and runs in the Common Language Runtime (CLR).
3. The three steps to creating a Visual Basic project are (1) define the user interface, (2) set the properties, and (3) write the Basic code.
4. Three types of errors can occur in a Visual Basic project: syntax errors, which violate the syntax rules of the Basic language; run-time errors, which contain a statement that cannot execute properly; and logic errors, which produce erroneous results.
5. Forms and controls can display images from the project's resources. Use the form's Background Image property and a control's Image property.
6. You can select multiple controls and treat them as a group, including setting common properties at once, moving them, or aligning them.
7. Variables are temporary memory locations that have a name (called an identifier), a data type, and a scope. A constant also has a name, data type, and scope, but it also must have a value assigned to it. The value stored in a variable can be changed during the execution of the project; the values stored in constants cannot change.
8. The data type determines what type of values may be assigned to a variable or constant. The most common data types are String, Integer, Decimal, Single, and Boolean.
9. The scope of a variable may be namespace level, module level, local, or block level. Block-level and local variables are available only within the procedure in which they are declared; module-level variables are accessible in all procedures within a form; namespace variables are available in all procedures of all classes in a namespace, which is usually the entire project.
10. Try/Catch/Finally statements provide a technique for checking for user errors such as blank or nonnumeric data or an entry that might result in a calculation error.
11. Use the Parse methods to convert text values to numeric before performing any calculations.

Key Terms

Argument
Block-level variables
Casting
Concatenation
Compiler
Declaration
Debugging
Desk checking
Documentation
Exceptions
Functions
Integrated Development Environment
Interpreter
Integer
Logic error
Loop structure
Machine language
OOP
Problem oriented language
Procedure
Procedural language
Run-Time Error
Selection structure
Scope
Sequence structure
Syntax error
Variables

Chapter 6 

Managing and Maintaining Data Online

Data is becoming the new raw material of business. Keeping it safe is critical for business success.

- Craig Mundie, Head of Research-Microsoft

After completing this chapter, you will be able to:

1. Learn about some common cloud storage services
2. Explain the differences between public, private or hybrid clouds.
3. Identify the service model of cloud systems architectures.
4. Recommend different cloud storage services.

6.0 Introduction

With the wider use of technology, the amount of data generated is growing exponentially - not just the amount of data, but also the sheer size of files. The hot topic in the field of data management is **Big Data.** Big Data refers to technologies and initiatives that involve data that is too diverse, fast-changing or massive for conventional technologies, skills and infrastructure to address efficiently.

Data is considered the most valuable asset to an organization and must be well protected. At the same time, this data should be easily and safely accessible.

Figure 6.1 Centralized and secure data storage is crucial

Today, thanks to new cloud technologies and high-quality networks, online data storage can provide not only cost savings but which help organizations secure and more efficiently store their data. Cloud services are not only available to big enterprises, but to small businesses and to individuals as well. It has also become the standard for storing files and transferring them between devices and users in the mobile era.

6.1 What is Cloud Computing?

Cloud computing is a type of computing that relies on *sharing computing resources* rather than having local servers or personal devices to handle applications.

In cloud computing, the word cloud (also phrased as "the cloud") is used as a metaphor for "*the Internet*," so the phrase *cloud computing* means "a type of Internet-based computing," where different services — such as servers, storage and applications — are delivered to an organization's computers and devices through the Internet.

Figure 6.2 Using cloud as a service for data storage, data sharing and data processing

Cloud Computing Service Models

IaaS, PaaS and SaaS are cloud computing service models.

1. **IaaS** (Infrastructure as a Service), as the name suggests, provides the computing infrastructure, physical or (quite often) virtual machines and other resources like virtual-machine disk image library, block and file-based storage, firewalls, load balancers, IP addresses, virtual local area networks etc. Examples include : Amazon EC2, Windows Azure, Rackspace, Google Compute Engine.
2. **PaaS** (Platform as a Service) provides the computing platforms which typically includes operating system, programming language execution environment, database, web server etc. Examples: AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, Apache Stratos.
3. **SaaS** (Software as a Service) model provides access to application softwares often referred to as on-demand softwares. One does not have to worry about the installation, setup and running of the application. Service provider will do that for you. You just have to pay and use it through some client. Examples: Google Apps, Microsoft Office 365.

Cloud Storage is networked storage, or disk space, available over a specific network - the Internet. Cloud storage allows you to store resources such as computer files on remote computers called servers. This remote infrastructure is installed and managed by highly specialized companies or experts.

How can Cloud Storage benefit you?

Online cloud storage is a simple idea that can make storing and accessing your important files, photos, music and documents a breeze. The benefits of storing data in a cloud include:

1. **Access to the documents anywhere** - The main advantage of keeping the documents in the cloud is that you can access them virtually anywhere with an internet connection. All cloud storage services have their own apps you can install on your mobile device. Most cloud storage services can also be used via browser, so accessing your files on a laptop or PC should be as fast and convenient as with your mobile device. Browser access can also be great for situations where you need to access your files using a device other than your own.

2. **Share the documents easily** - In addition to being able to access your documents anywhere, sharing is another important reason to use a cloud service. Usually, the person you decide to share a file or a folder with needs to be a user of that same cloud storage service. Whether it is lecture materials or work documents, sharing in the cloud is super easy & fast!
3. **Keep the documents safe** - If you lose or damage your laptop or mobile device, you could potentially lose thousands of digital photos, important files, or your entire music collection. Using cloud storage as a depository for your files ensures they are safe should your device get broken or lost. When using cloud storage services with DocScanner, you can set DocScanner to auto-upload your documents to the cloud.
4. **Get cloud storage space for free or at very low cost** - Almost all cloud storage services operate on the *freemium* model, where you get a certain amount of space free of charge, and more when you pay. At the moment, premium subscription for Evernote gives you 1 GB of monthly uploads and costs only five dollars per month. Even if you decide to go for the free plan, you still get 60 MB of monthly uploads – still enough for dozens of documents. A 100 GB subscription to Dropbox costs $120 per year, or $9.99 per month, and basically gives you a second hard drive. If you don't need that much, you can still have 2 GB for free.
5. **Accumulate a personal file archive in the cloud you can use in different occasions** - Showing photos to your friends & relatives? Sharing lecture materials with other students at school? Storing receipts in the cloud for accounting? You can accumulate a personal archive in the cloud you can access anywhere, anytime. Different cloud services can be used for different purposes. Upload documents and receipts to Spideroak, share photos on Dropbox, and collaborate on office documents on Google Drive.

6.2 Common Cloud Storage Services

6.2.1 Google Drive

Google Drive is a just one part of the Google cloud, but it is without a doubt one of the most important parts. It not only permits users to save their important (and large) files, but also share them with others whenever they desire. That being said, it is no surprise that Google Drive has been gaining in popularity lately, and that a number of third party apps have been developed in order to make the whole drive experience more useful than just a folder in the cloud.

Google Drive is actually compatible with a number of apps, all of which can be installed from the Chrome store. Some of them are free, and while other cost, they are never quite enough to break the bank. The best part about these applications is that they perform highly useful functions that one might have expected from standard (expensive) desktop applications just a few years ago.

- Manage Projects
- Create Flow Charts
- Edit Images
- Edit Videos

- Sign Documents
- And much, much more.

Google Drive Apps are slowly but surely replacing the desktop application. With tablets and low capability netbooks (ChromeBooks, etc.) replacing the larger, bulkier desktops, it is becoming more and more necessary for us to utilize cloud applications, such for document, spreadsheet and presentation creation online.

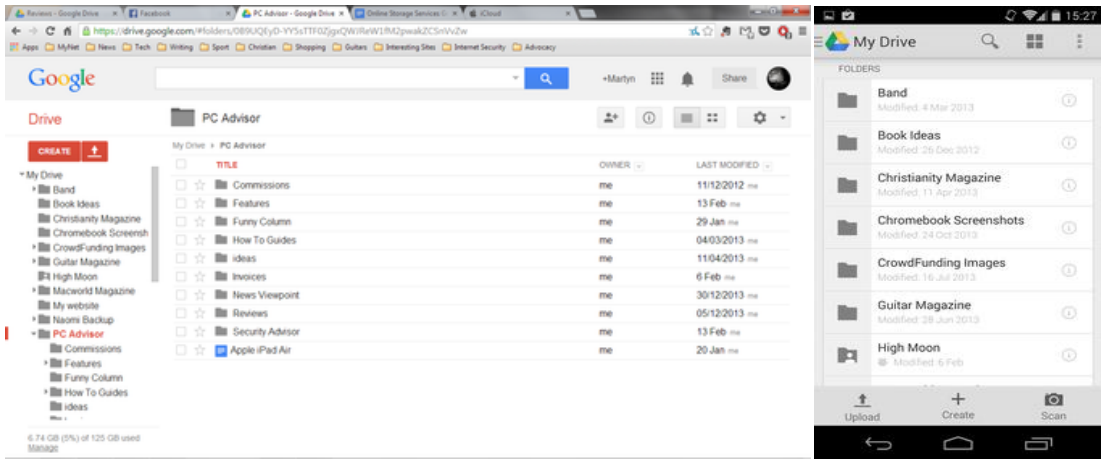


Figure 6.3 Web and Mobile Interface for Google Drive

6.2.1 One Drive (previously known as Sky Drive)

Amid the excitement over Google Drive, the search giant's new Dropbox competitor, Microsoft recently improved a similar online sync and storage service, SkyDrive. Similar to Google Drive/Docs and Dropbox, OneDrive enables users to store their files in the cloud and access them from their mobile devices or personal computers.

And like Google Drive/Docs, users can share word processing documents, spreadsheets, and presentations for the purposes of concurrent collaboration. Editing and collaborating is available through the free online version of Microsoft Office products — including Word, Excel, and PowerPoint. OneDrive also includes the ability to create and share OneNote notebooks and Excel surveys, as well as to modify files created with the desktop version of MS Office. One Drive is a free download with 7GB of free storage for starters and upgrade options are available. The mobile app for file access is free and available for Windows Phone, Android, iPhone, and iPad.

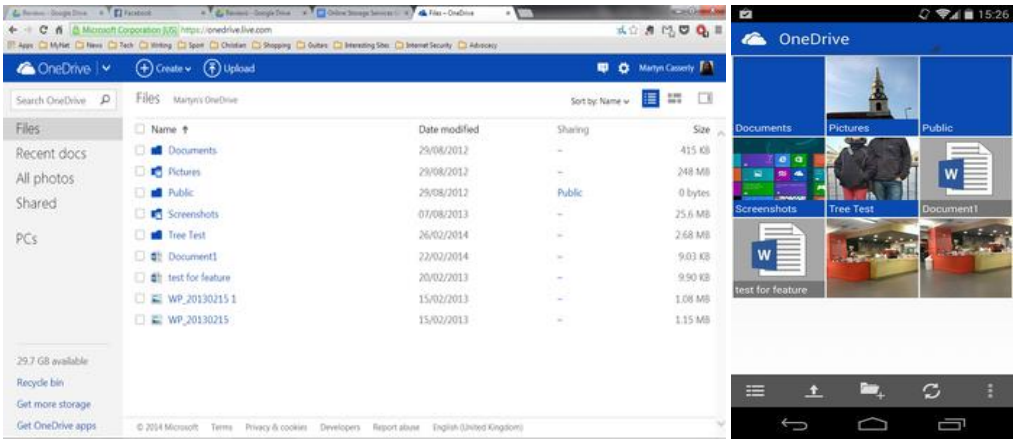


Figure 6.4 Web and Mobile Interface for One Drive

6.2.3 Dropbox

Dropbox is one of the only online storage solutions to offer clients for Linux and Blackberry, alongside the usual Windows, Mac OS X, Android and iOS standards - although an official Windows Phone app still remains elusive. This goes a long way to ensuring that your data can be with you, no matter what flavour of technology you want to use.

Other ways to bolster the account include linking it to Facebook, Twitter, or setting up a Mailbox account. Dropbox functions by creating a local folder on your device or PC that then syncs with an online version. This means you have all your data available whether you are on or offline. Files appear quickly online once you place them in the Dropbox folder on your PC, and you also have the option of making select files available offline on your tablet or smartphone (they're all offline by default), with offline editing functionality among the best we've seen.

Folders and files can also be shared with friends either by sending them links (these work for non-Dropbox users) which allow them to view the data, or by Sharing the file. An important point to note about sharing is that you can't set permissions, so files can be edited (and even deleted) by other users.

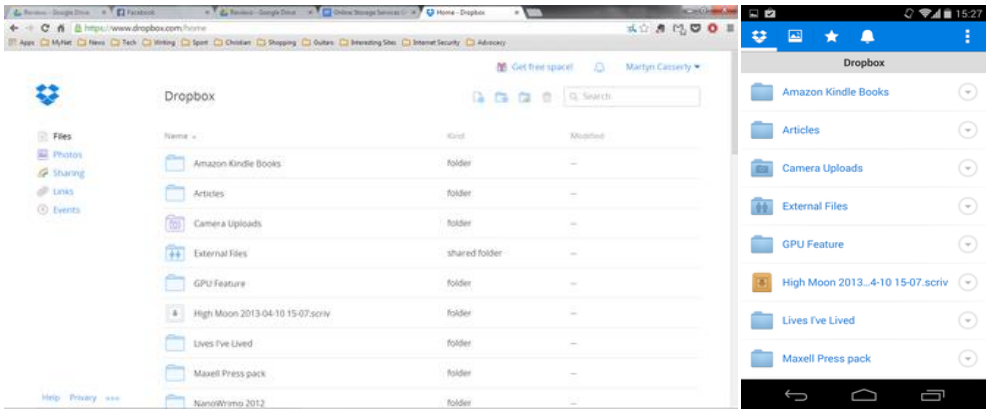


Figure 6.5 Web and Mobile Interface for Dropbox

6.2.5 iCloud

iCloud approaches cloud storage with a distinctly Apple-centric view. Unlike the other services here, iCloud isn't really a drag and drop-style folder for anything you need to back up. Instead it is linked to various aspects of the company's devices.

iPhones and iPads have a tightly integrated relationship with the service, which automatically stores data about purchased apps, keychain (password) settings, alongside calendar, contact, and email information.

Photo taken on iOS devices are backed up on iCloud, but it isn't possible to do this from Android or Windows handset which obviously isn't ideal. You can access files from a Windows PC if you download the Control Panel software from Apple, or log on to the iCloud.com website.

iCloud also allows you to have any purchases made on the iTunes store automatically download to your library no matter which device you used to buy it. Photos are synched across all devices which are logged into your iCloud account, but not videos. One particularly neat feature is that, in addition to synching your Safari bookmarks across devices, you can also see a list of open web pages on other iDevices.

A recent addition to iCloud is iWork - Apple's Office suite - now available for free via the website. The three apps - Pages, Numbers, and Keynote - have clean interfaces, work well up to a point, and sync with the equivalent apps on your Mac or iOS device.

This means you can start work on your iPad then continue without issue on your PC (files can be downloaded from iCloud.com in Microsoft Office formats). The functionality is a little basic, most likely so that it ties in with the iOS versions of the software, but syncing between devices and the cloud is fast and reliable.

Services such as Dropbox are designed to cater for whatever you need on whichever platform you prefer, but iCloud feels like primarily a mobile solution. Sure, files and photos synch to your Mac or PC pretty much instantly, but the real benefits are linked to apps (such as Messages) and settings, which backup their data to the cloud and allow you to restore everything to a new iPhone or iPad should your old one be stolen, fail or be damaged.

Figure 6.6 Interface for iCloud

6.2.5 Spideroak

If privacy is a major concern, then Spideroak might be the cloud storage service for you. Most of the mainstream offerings such as Dropbox, Google Drive, OneDrive, and Box all encrypt your data on their servers, but Spideroak has a different approach.

Once you've set up your account and downloaded the desktop client (Windows, Mac, and Linux are available) you can transfer files to your local folder, which will then encrypt them before syncing them to Spideroak. This might not sound that different, but it means that your data is readable only by you, as the key is local to your machine. Spideroak calls this 'Zero-knowledge privacy' as the employees at the company can't access your data and, by extension, it should also mean any interested government parties would also find it extremely difficult.

Traditionally this would make accessing files from numerous machines more problematic, not to mention sharing with others, but the team has worked ways around that. Spideroak Hive is the control centre of your storage. This app, which runs locally, is very similar to the Dropbox-style of folder on your desktop, although the interface has a little more detail.

This includes which of your other devices have the desktop app installed, and gives you access to the file tree within their Spideroak Hive folders. You can also choose local files to backup via a menu, and there are helpful stats to keep you up to date with the activity on your account.

Where rivals such as Google Drive and OneDrive are tightly integrated into wider productivity suites, Spideroak is simply there to store your files securely. This means no Office-style apps, or online collaboration with colleagues. You can easily share items and send secure links to files from the Spideroak Hive, although this involves setting up a Share ID (free and simple) as another way to protect your data.

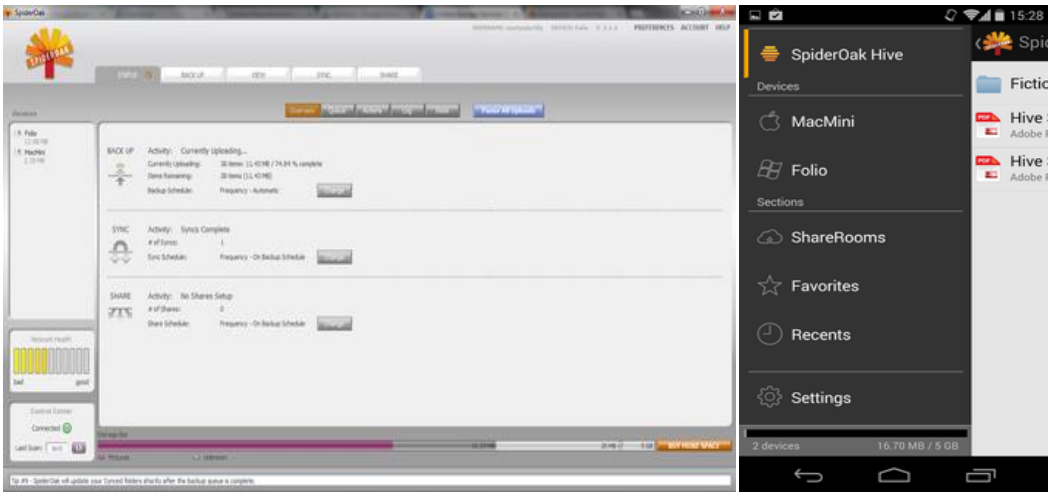


Figure 6.7 Web and Mobile Interface for Spideroak

6.2.6 Amazon Cloud Drive

Not to be left out in the battle of the big players, Amazon has its own cloud storage solution to take on the likes of Google and Microsoft. The focus of Cloud Drive is simpler than its counterparts, in that there are no fancy plug-ins or web-based Office suites to add productivity to your data.

Instead, it's very much focussed on being a place to store your documents, photos and videos. The desktop app is available on PC & Mac and once downloaded it will take the form of a folder that sits quietly in the background waiting for you to drag files into it.

The mobile experience with Cloud Drive is very basic, and is centred around photo and video syncing. A very curious choice is to not make documents available in the mobile apps. If you add Word, PDF, or XLS files to the Cloud Drive folder on your PC they will sync with the Cloud server, but won't appear on your smartphone or tablet.

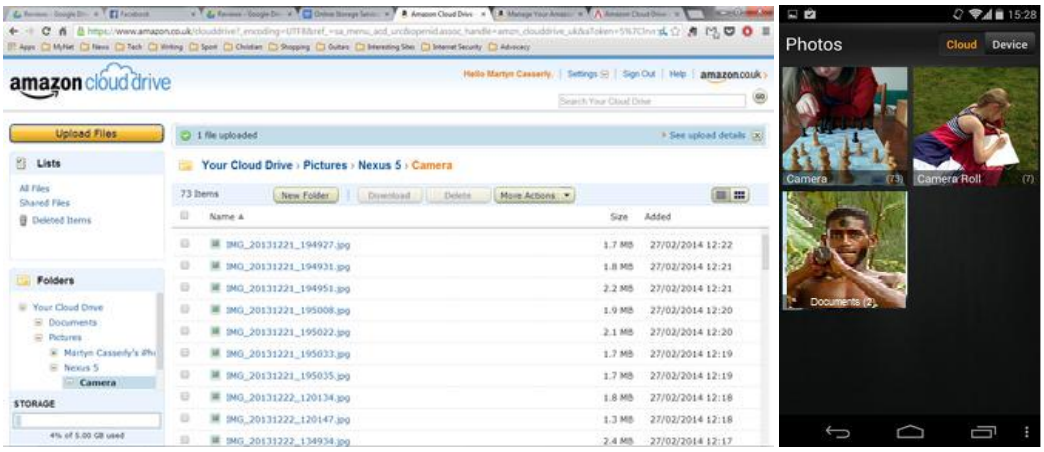


Figure 6.8 Web and Mobile Interface for Amazon Cloud Drive

Practical Task

Trying signing up for one of the above free cloud storage services. Write a one page report discussing the various features available via the service. Explain how each of these feature can assist you in better

6.2.7 Comparison of online Cloud Storage Services

Dropbox	Microsoft SkyDrive	Google Drive
• Free space: 2GB (plus up to 16GB for referrals) • Premium space: $10/month for each 100GB, up to 500GB • File size limit: Unlimited (via desktop app) • Platforms: Windows, Mac, Linux, iOS, Android, BlackBerry • Best for: Seamless document syncing	• Free space: 15GB • Premium space: $2/month for 100GB, $4/month for 200GB • File size limit: 2GB • Platforms: Windows, Mac, iOS, Android, Windows Phone • Best for: Windows/MS Office integration	• Free space: 10GB • Premium space: $2/month 100GB, $10/month for 1TB • File size limit: 10GB • Platforms: Windows, Mac, iOS, Android • Best for: Storage space and web apps

Apple iCloud	Spideroak	Amazon Cloud Drive
• Free space: 5GB • Premium space: $0.99/ month for 20GB, and $3.99 for 200GB cloud drive. • File size limit: 25MB free/250MB paid • Platforms: Mac, iOS, Windows • Best for: Heavy iTunes/Mac users	• Free space: 2GB • Premium space: $100 USD per year for 100GB • File size limit: None • Platforms: Mac, iOS, Android, Windows • Best for: Backup, sync, access and share files	• Free space: 5GB • Premium space: £32 per year for 100GB • File size limit: 2GB per file • Platforms: Mac, iOS, Android, Windows • Best for: Photos and music

Table 6.1 Comparing some common cloud storage services for individuals

6.3 Switching to the Cloud Service for Data Management

As businesses look to maximise their IT return on investment and increase functionality, hosted services are playing an increasingly prominent role. Cloud computing adoption is continuing apace, across a host of industry sectors, as more organisations recognise the benefits it can potentially offer.

Firms can choose to deploy applications on **Public**, **Private** or **Hybrid** clouds.

Public Clouds

Public clouds are owned and operated by third-party service providers. Customers benefit from economies of scale because infrastructure costs are spread across all users, thus allowing each individual client to operate on a low-cost, "pay-as-you-go" model. Another advantage of public cloud infrastructures is that they are typically larger in scale than an in-house enterprise cloud, which provides clients with seamless, on-demand scalability.

It is also important to note that all customers on public clouds share the same infrastructure pool with limited configurations, security protections and availability variances, as these factors are wholly managed and supported by the service provider.

Private Clouds

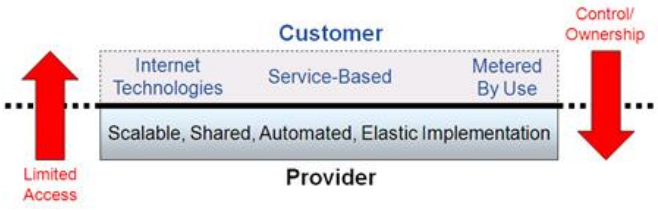
Private clouds are those that are built exclusively for an individual enterprise. They allow the firm to host applications in the cloud, while addressing concerns regarding data security and control, which is often lacking in a public cloud environment. There are two variations of private clouds:

- **On-Premise Private Cloud**: This format, also known as an "internal cloud," is hosted within an organization's own data center. It provides a more standardized process and protection, but is often limited in size and scalability. Also, a firm's IT department would incur the capital and

operational costs for the physical resources with this model. On-premise private clouds are best used for applications that require complete control and configurability of the infrastructure and security.

- **Externally-Hosted Private Cloud**: This private cloud model is hosted by an external cloud computing provider (such as Eze Castle Integration). The service provider facilitates an exclusive cloud environment with full guarantee of privacy. This format is recommended for organizations that prefer not to use a public cloud infrastructure due to the risks associated with the sharing of physical resources.

The following graphic shows the difference between customer private clouds and provider private clouds.



Hybrid Clouds

Hybrid clouds combine the advantages of both the public and private cloud models. In a hybrid cloud, a company can leverage third-party cloud providers in either a full or partial manner. This increases the flexibility of computing. The hybrid cloud environment is also capable of providing on-demand, externally-provisioned scalability. Augmenting a traditional private cloud with the resources of a public cloud can be used to manage any unexpected surges in workload.

But why exactly are businesses choosing to spend on hosted services, delivered remotely by a third party, rather than investing in their own on-premise infrastructure? Here are some of the main benefits of cloud storage technologies:

Advantages for Cloud Storage Services

Storing files remotely rather than locally boasts an array of advantages for both home and professional users. Here are some reasons to get rid of your external hard drive in favor of online storage services.

1. **Cost** – Backing up your data isn't always cheap, especially when you factor in the cost of any equipment needed to do so – think external hard drives or backup tapes. Additionally, there is the cost of the time it takes to manually complete routine backups. Online storage services reduce much of the cost associated with traditional backup methods, providing ample storage space in the cloud for a low monthly fee.
2. **Invisibility** – For all intents and purposes, cloud storage is invisible; with no physical presence, it doesn't take up valuable space at home or in the office.
3. **Security** – Storing confidential or sensitive information in the cloud is often more secure than storing it locally, especially for businesses. With online storage services, data is encrypted both during transmission and while at rest, ensuring no unauthorized users can access the files.

4. **Automation** – The biggest issue most consumers and businesses have with backing up is follow through; it simply just doesn't get done. Online storage services make the tedious process of backing up easy to accomplish through automation. You simply select what and when you want to back up, and the service does the rest.
5. **Accessibility** – From tablets to smartphones, netbooks to desktops, we're using more devices on a daily basis than ever before, and toggling files between each of these devices can be cumbersome and complex. Not so with online storage services. You can access your account from any internet connection, whether you're on a mobile browser or your work computer.
6. **Syncing** –Syncing ensures your files are automatically updated across all of your devices. This way, the latest version of a file you saved on your desktop is available on your smart phone.
7. **Sharing** – Whether you want to share a single photo or an entire folder with hundreds of documents, online storage services allow you to easily share files with just a few clicks.
8. **Collaboration** – Online storage services are also ideal for collaboration purposes. They allow multiple people to edit and collaborate on a single file or document. You don't have to worry about tracking the latest version or who has made what changes.
9. **Protection** – Cloud storage serves as an added layer of data protection for your precious and irreplaceable files. Backups are kept in a secure location that is physically removed from the originals.
10. **Recovery** – In the event of catastrophic data loss, you'll have backups of all your original files so you can restore them with zero downtime.

Disadvantages of Cloud Storage Services

Like all new technologies, cloud computing has its fair share of disadvantages. While this affects in general all users, private users or smaller companies are the ones who may feel slightly more disadvantaged than larger businesses.

1. **Network Connections Dependency -** Cloud computing/storage needs network connections to work. When the network is down, cloud services are down as well. What's more, when the network runs slowly, your services run slowly as well, and your work is affected. Even if cloud computing providers take precautions to ensure that the network has a great uptime, the risk will always remain.
2. **Connecting Peripherals -** Companies that have a dedicated network for peripherals don't have as many problems as those who don't. Connecting wireless devices can be difficult, especially when it comes to personal devices. Software incompatibilities are another problem. A large number of devices are still designed to connect specifically with a PC, so that some functions like printing, may only be performed if you have a PC with the right software on it.
3. **Data Ownership** - As one of the biggest issues that trouble cloud computing, data ownership can be a major obstacle, especially if you have a lot of data to deal with. As of yet there is no straightforward answer to a basic question such as 'who owns the data maintained by a cloud storage service, the uploader or the storage provider?'. As a result, cloud providers create their own terms and conditions, which at times may seem arbitrary. Therefore, reading the small print is necessary when you deal with cloud computing, and especially with cloud hosting. Also note that at times you may not be allowed to upload a certain type of data.

4. **No Hard Drive** - For some users the lack of a hard drive is an advantage, as they can reduce costs. For those who use programs that need an attached hard drive, however, this may be unpleasant. Still, an increasing number of companies eliminate the need for a hard drive, in an effort to make data management easier.
5. **Security** - Although security in the cloud is generally good – hackers don't have a definite target that they can attack – there still are some serious security concerns. For instance, the interconnectedness of servers in the cloud may lead to a situation in which a hacker breaches one system and then can make their way into other linked systems.

Many of the disadvantages of cloud computing are due to the fact that the technology is still relatively new. In other words, they will be addressed in time, as more and more users adopt cloud computing. Nevertheless, no technology is perfect, and cloud computing is no exception: when getting cloud services take into account all the possible disadvantages.

Summary

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1. Big Data refers to technologies and initiatives that involve data that is too diverse, fast-changing or massive for conventional technologies, skills and infrastructure to address efficiently.
2. Cloud computing is a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications.
3. IaaS, PaaS and SaaS are cloud computing service models.
4. Online cloud storage is a simple idea to store and accessing your important files, photos, music and documents on a third party server.
5. Examples of online Cloud Storage services include Google Drive, One Drive, iCould, Amazon Cloud Storage, Spideroak and Dropbox.
6. An advantage of public cloud infrastructures is that they are typically larger in scale than an in-house enterprise cloud, which provides clients with seamless, on-demand scalability.
7. Private clouds are those that are built exclusively for an individual enterprise.
8. In a hybrid cloud, a company can leverage third-party cloud providers in either a full or partial manner.

Key Terms

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big data	cloud computing
data management	Dropbox
Google Drive	Hybrid Cloud
IaaS	iCloud
One Drive	PaaS
Private Cloud	Public Cloud
SaaS	Spideroak

Review Questions – True/False

a) Users can share entire folders in Dropbox, even with people outside of their own company's IT infrastructure.
b) Cloud computing is a model of computing in which your computer acts as a terminal and a network of servers handles the processing power and storage for you
c) Google Docs is a type of cloud computing.
d) An Internet connection is necessary for cloud computing interaction.

Review Questions – Short Answer

1) What does SaaS ,PaaS and IaaS stand for?
2) What is private cloud?
3) List two advantages and two disadvantages of :
    a. Private Cloud
    b. Public Cloud
    c. Hybrid Cloud
4) Discuss the benefit of cloud services for a typical Year 12 student in high school?
5) State the benefit of cloud services for a telecommunication company like Digicel Fiji?
6) Amazon Web Services is which type of cloud computing distribution model? Explain?

Review Questions – Multiple Choice

1) "Cloud" in cloud computing represents what?
    a. Wireless
    b. Hard drives
    c. People
    d. Internet

2) Which company makes a personal cloud storage service?
    a. Apple
    b. Microsoft
    c. Amazon
    d. All of the above

3) Which of the following isn't an advantage of cloud?
    a. No worries about running out of storage
    b. Easier to maintain a cloud network
    c. Immediate access to computing resources
    d. Paying only for what you use

4) What is Cloud Computing replacing?
    a. Corporate data centers
    b. Expensive personal computer hardware
    c. Expensive software upgrades
    d. All of the above

5) What is the number one concern about cloud computing?
    a. Too expensive
    b. Security concerns
    c. Too many platforms
    d. Accessibility
6) Which of these companies is not a leader in cloud computing?
    a. Google
    b. Amazon
    c. Blackboard
    d. Microsoft

7) Which one of these is not a cloud computing pricing model?
    a. Free
    b. Pay Per Use
    c. Subscription
    d. Ladder
    e. Perpetual License

8) Which of these is not a major type of cloud computing usage?
    a. Hardware as a Service
    b. Platform as a Service
    c. Software as a Service
    d. Infrastructure as a Service

9) Which of these should a company consider before implementing cloud computing technology?
    a. Employee satisfaction
    b. Potential cost reduction
    c. Information sensitivity
    d. All of the above

10) Which of the following steps should you take when choosing a business cloud storage provider?
    a. Assess your needs
    b. Examine your company's security policies
    c. Try out a few providers' services
    d. All of the above

11) Which of the following is a benefit of personal cloud storage use for businesses?
    a. Personal cloud storage services eliminate IT's control over data
    b. Users are always working on the most up-to-date version of a document
    c. Consumer cloud storage services don't usually use complex authentication methods
    d. All of the above

12) What is the name of the organization helping to foster security standards for cloud computing?
    a. Cloud Security Standards Working
    b. Cloud Security Alliance
    c. Cloud Security WatchDog
    d. Security in the Cloud Alliance

13) What is the term for the applications that allow computers to communicate within a cloud computing network?
    a. Middleware
    b. Firmware
    c. Software
    d. Freeware

14) What is the term for restricting users so that they can only access the features they're assigned?
    a. Authorization
    b. Authentication
    c. Administration
    d. Allocation