3. COMPUTER SOFTWARE

SOFTWARE:

It is a program that consists of step by step instructions that tell the computer how to perform a given task.

NB:

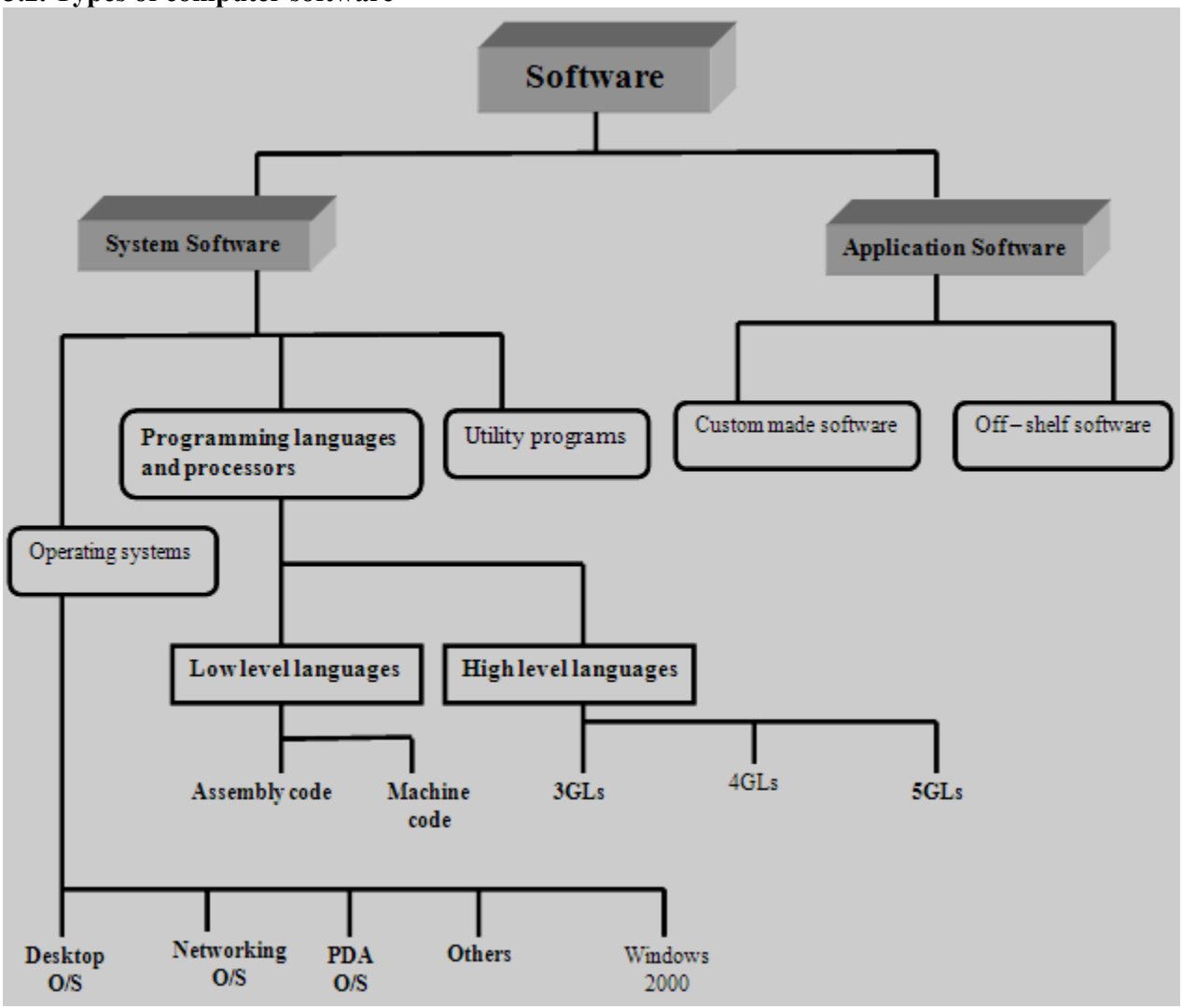
A program;

A ***computer program*** is a sequence of instructions, written to perform a specified task with a computer.

3.1. Characteristics of software

- Computer software is intangible
- Computer software gives instructions/procedures to computers
- Computer software is copyrighted
- Computer software can be installed
- Computer software is executable
- Loads into Memory when running
- All software has a source Code written by a programming Language.

3.2. Types of computer software



3.2.1. SYSTEMS SOFTWARE

- These are a set of instructions that control the operation of the computer and its devices.
- It refers to the various computer programs that control the way a computer operates.

3.2.1.1. Characteristics of system software

- It is machine dependent.
- It serves as the interface between the user, the application software and the hardware.
- They are written by computer programmers or professional system programmers.
- Some of these programs stay / reside in ROM (permanently) hence known as firmware.
- It is usually supplied by the manufacturers of the computer

3.2.1.2. Types of system software

a) Operating system

b) Utility software

c) Programming languages

a) OPERATING SYSTEM;

It is a set of programs that coordinate the operation of all hardware and application software components of a computer

The operating system relies on **device drivers** to communicate with each device in the computer.

Definition;

A device driver is a small program that tells the operating system how to communicate with a device.

Functions of the Operating System

 Controls the hardware resources like accessing disk drives, printers and keyboard.

 Calling into memory programs and instructions when required.

 Protecting hardware, software and data from improper use e.g. when deleting a file.

 Provides error correcting routines e.g. when data is lost during transfer, it should be recovered.

 Communicating with the user e.g. reporting suspended program due to error, request for operation e.g. insert disk.

 Manages files and memory thereby saving the user from knowing where in memory his files are to be stored.

 Scheduling and loading programs so as to provide a continuous sequence of operation.

 Enables application software to interface with the hardware.

 Provides an interface between the user and the application software and the hardware.

 Manipulating data

 Managing the processor

 Providing security

 Managing multitasking

- Provides basic working environment/interface.
- Controlling the use of peripherals.
- Controlling the loading and running of application programs.
- Organizing the use of memory/Memory management
- Booting

- File management
- Protecting hardware and software
- Configuring devices
- Processor management e.g multitasking and time sharing.

Examples of operating system software

i) Disk Operating System (DOS)

- This is a single user interface which was developed in the early 1980 for personal computers.
- It uses a command line interface (CLI)
- It is the main system control program that enables the computer to operate.

Examples of DOS

 PC DOS developed by Microsoft for IBM

 Ms DOS which was sold to makers of IBM compatible PCs by Microsoft

NB;

USER INTERFACE

This controls how users enter data and instructions into the computer and how information is displayed on the screen.

Types of User Interfaces

a) Command Line Interface (CLI)

This is a kind of interface which allows a user to type key wards or press special keys on the keyboard to enter data and instructions into a computer.

Advantages of CLI

 Takes up little space

 Doesn‘t require a very fast processor.

 Operation is quite fast because commands can be entered directly through the key board.

 Many commands can be grouped together as a batch file so that repetitive tasks can be automated.

Disadvantages of CLI

 A command language has to be learnt and memorized.

 It is not user friendly.

 The interface may vary from application to application.

b) Graphical User Interface (GUI)

This is the kind of interface that allows a user to use menus and visual images such as icons, buttons and other graphical objects to enter commands into the computer.

Advantages of a GUI

 It is user friendly

 No need to type or memorize any command language

 The interface is similar for any application.

Disadvantages of a GUI

 Requires more memory

 Requires a very fast processor.

 It is difficult to automate functions for expert users.

 Occupies more disk space to hold the files for all the different applications.

ii) Windows Operating System

- This is an operating system that uses icon – based graphical user interface that simplifies working on a computer.

Versions of windows;

- Windows 3.0
- Windows 95
- Windows 98
- Windows NT workstation
- Windows 2000 professional
- Windows M.E (Millennium)
- Windows Xp Home
- Windows Xp Professional
- Windows Vista
- Windows 2000 server

iii) Networking Operating Systems (NOS)

It is a system software that organizes and coordinates the activities on a LAN.
These O/S are designed to be used on several computers that exist on a network.
They include;

- Novell Netware
- Sun Solaris
- Windows NT
- UNIX
- Linux
- IBM OS/2 wrap
- Microsoft windows 95, 98, ME, NT, 2000 server, XP, etc.

Tasks performed by NOS

- Administration of network users
- System maintenance tasks such as backup
- File management tasks
- Prioritizing print jobs on the network
- Monitoring security on network resources

iv) UNIX

- It is a multi user O/S.
- It can run multiple applications at the same time (multitasking)
- It was developed in 1970s by scientists at Bell laboratories.
- It has a command line interface and most of its commands are difficult to remember.

v) Linux

- It is an ―Open Source‖ software i.e. its code is made available to the public.
- It is a popular, free UNIX – like multitasking operating system.

vi) Palm O/S

Is an operating system designed for the hand – held computers (Personal Digital Assistants – PDAs)
Examples of palm O/S; Pocket PC 2002

vii) Windows CE

Is a windows operating system designed for use on wireless communication devices and hand – held computers.

Utility programs

A ***utility program*** is a type of system software that allows a user to perform maintenance-type tasks, usually related to managing a computer, its devices, or its programs.
Utility programs included with most operating systems provide the following functions:

- Managing files, searching for files,
- Viewing images,
- Securing a computer from unauthorized access,
- Uninstalling programs,
- Scanning disks,
- Defragmenting disks,
- Diagnosing problems,
- Backing up files and disks,
- Setting up screen savers .etc

Examples of utility programs

i) A file manager;

It is a utility that performs functions related to file and disk management.
Windows Vista and XP include file managers called *Explorers* (Documents Explore, Pictures Explore, and Music Explore).

Functions performed by file managers

- Formatting and copying disks
- Organizing files in folders
- Displaying a list of files on a storage medium
- Checking the amount of used or free space on a storage medium
- Organizing, copying, renaming, deleting, moving, and sorting files; and
- Creating shortcuts.

NB: A ***folder*** is a specific named location on a storage medium that contains related documents.
A ***shortcut*** is an icon on the desktop that provides a user with immediate access to a program or file.
Formatting is the process of preparing a disk for reading and writing.

ii) A search utility

Is a program that attempts to locate a file on your computer based on the criteria you specify.
The criteria could be a word or words contained in a file, date the file was created or modified, size of the file, location of the file, file name, author/artist, and other similar properties.

iii) An image viewer

Is a utility that allows users to display, copy, and print the contents of a graphics file.
With an image viewer, users can see images without having to open them in a paint or image editing program.

iv) A personal firewall

Is a utility that detects and protects a personal computer from unauthorized intrusions.
Personal firewalls constantly monitor all transmissions to and from a computer.
When connected to the Internet, your computer is vulnerable to attacks from hackers (people who tries to access a computer or network illegally).

v) An uninstaller

Is a utility that removes a program, as well as any associated entries in the system files.
In Windows Vista and Xp, you are able to access the uninstaller for many installed programs through the "Uninstall a program" command in the Control Panel.

You also are able to access the uninstaller for some programs through that programs folder on the Start menu, or on the program's installation media.
The uninstaller deletes files and folders from the hard disk, as well as removes program entries from the system files.

Examples of uninstallers;

McAfee's uninstaller

vi) A disk scanner

Is a utility that searches for and removes unnecessary files from the hard disk.
Windows Vista and XP includes a disk scanner utility, called ***Disk Cleanup***, which searches for and removes unnecessary files such as temporary files.
It is used to detect and correct both physical and logical problems on a hard disk or floppy disk and searches for and removes the unwanted files.
A physical problem is one with the media e.g. any scratch on the surface of the disk.
A logical problem is one with the data e.g. corrupted File Allocation Table (FAT)
Examples of disk scanner
- Scan Disk
- Disk Clean Up.

vii) A disk defragmenter

Is a utility that reorganizes the files and unused space on a computer's hard disk so the operating system accesses data more quickly and programs run faster.
When an operating system stores data on a disk, it places the data in the first available sector on the disk. It attempts to place data in sectors that are contiguous but this is not always possible.
When the contents of a file are scattered across two or more noncontiguous sectors, the file is *fragmented*.
Fragmentation slows down disk access and thus the performance of the entire computer.
Disk defragmentation enables data to be accessed more quickly and programs to be run faster.
Examples of defragmenter in windows is the **Disk defragmenter**
NB;
Defragmentation
Is the process of reorganizing the disk so that the files are stored in contiguous sectors.

viii) A diagnostic utility

- This compiles technical information about your computer's hardware and certain system software programs and then prepares a report outlining any identified problems.
- For example, Windows Vista includes the diagnostic utility ***Problem Reports and Solution*****,** which diagnoses problems as well as suggests courses of action.
- Information in the report assists technical support staff in remedying any problems.
- Windows Xp has ***Dr. Watson*** as a diagnostic utility.

ix) A backup/Copy utility

- This allows users to copy, or *back up*, selected files or an entire hard disk to another storage medium. During the backup process, the backup utility monitors progress and alerts you if it needs additional media, such as another CD or tape.
- Many backup programs compress, or shrink the size of files during the backup process.
- Because they are compressed, you usually cannot use backup files in their backed up form. In the event you need to use a backup file, a ***restore program*** reverses the process and returns backed up files to their original form.
- Backup utilities include restore programs.
- You should back up files and disks regularly in the event your originals are lost, damaged, or destroyed.

x) A screen saver

This is a utility that causes a display device's screen to show a moving image or blank screen if no keyboard or mouse activity occurs for a specified time.
When you press a key on the keyboard or move the mouse, the screensaver disappears and the screen returns to the previous state.

Importances of screen savers

- Screen savers originally were developed to prevent a problem called **ghosting**, in which images could be permanently etched on a monitor's screen.
- Screen savers also are popular for security. They prevent unwanted lookers from accessing information or data from your computer.

To secure a computer, users configure their screen saver to require a password to deactivate.

- Business – advertisements on the screen.
- Entertainment- in which digital photos can be put on your screen as moving pictures.

xii) Sorting Utility

- These are utility programs used to take in data and re – arrange it in any order as specified by the user.
- The order can be ascending or descending order.

xiii) Merging Utility

- These programs are used to combine two or more files to produce one file.

xiv) Antivirus Software

- This is used to prevent, detect and remove viruses from a computer‘s memory or storage devices.
- Examples include; **Norton Antivirus, Avira, Panda, Pc – Cillin, Dr. Solomon, McAfee, Avast antivirus, AVG antivirus, Kaspersky antivirus, Escan antivirus, F – secure antivirus, Netqin antivirus, Eset – Nod 32 antivirus, e.t.c.**

xv) A file compression utility;

- It is used to reduce or shrink the size of a file.
- A compressed file takes up less storage space on a hard disk than the original file.
- Compressing files frees up room on the storage media and improves system performance.
- In order to reduce transmission time, email attachments, and files to be uploaded or downloaded should always be compressed.
- When you receive or download a compressed file, you must uncompress it.
- Some operating systems such as Windows XP and Vista include uncompress capabilities
- Compressed files are sometimes called ***zipped files*** because they have a ***.zip*** extension.
- Examples of compression utilities; **PKzip, WinZip, Winrare.t.c.**

xvi) A media player;

- Is a program that allows you to view images and animation, listen to audio, and watch video files on your computer.
- Media players may also include the capability to organize media files, convert them to different formats, connect to and purchase media from an online media store, download podcasts and vodcasts, burn audio CDs, and transfer media to portable media players.
- Windows Vista and XP include Windows Media Player.
- Three other popular media players are iTunes, RealPlayer, and Rhapsody.

xvii) file viewer utility program

A file viewer utility program is the one that displays and copies the contents of a file.
An operating system‘s file manager often includes a file manager.

xviii) Disk checkers

These can scan the contents of a hard disk to find files or areas that are faulty.

xix) Disk cleaners

These can find files that are unnecessary to computer and can decide to delete.

xx) Disk compression

These utilities can transparently compress / uncompress the contents of a disk, increasing the capacity of the disk.

b) PROGRAMMING

b) PROGRAMMING LANGUAGES

A programming language is a set of instructions used to direct the operation of a computer.

Characteristics of programming languages

- Every programming language has instructions for input and output.
- Has instructions for calculations.
- Instructions for transfer of control instructions for data storage and retrieval.

- Instructions for data movements.

Categories of programming languages
There are two categories of programming languages;
1. Low Level Languages
2. High Level Languages

1. Low Level Languages

(i) Machine Code (First generation Language or 1GL)

- It consists of binary numbers that represent instructions, memory locations and data.

- Information is stored in computer circuits as electrical ―ONs‖ and ―OFFs‖ which can be represented in the binary system by 1 and 0 respectively.

- This is the only language that can be directly used by a computer.

Examples of binary codes

VALUE	BINARY CODE
A	01000001
B	01000010
C	01000011
1	00000001
2	00000010
3	00000011

Advantages of machine code
- ✓ It is efficient
- ✓ Allows control of each operation

Disadvantages of machine code
 It is very difficult to learn and very unfamiliar to humans.

 It is not user friendly

 Each type of processor had its own set of codes. Therefore, machine code programs written for one processor could not be used on another.

 It is very tiresome to program in machine code language and many errors are likely to occur.

(ii) Assembly language (Second generation Language or 2GL)

- This kind of low level language used English – like tags such as ―ADD‖ or ―SUB‖ for the codes to add or subtract values.
- These tags were called **Mnemonics.** They could stand for zeros and ones of machine language.

- An assembly language program has to be translated into machine language by an **assembler.**

Advantages of assembly language
- ✓ Programs could be written more easily that with machine language.
- ✓ Had a closer control over the computer hardware and executes very efficient.
- ✓ It is useful for writing operating systems and game programs which require fast and efficient CPU.

Disadvantages of assembly language
 They are also designed for specific machines and specific processors.

 Programming in these languages is tiresome because programs cannot be moved from one computer architecture to another without re – writing the code.

2. High Level Languages (Third generation Languages or 3GLs)

- A high level language is a language which consists of statements that resemble human language or mathematical notations.

- They are machine independent.
- Fewer instructions are written and therefore a lot is done in less time.
- It has a wide vocabulary of valid words, symbols and sentences.
- Translation of high level program into machine code is done by language translators (**Compilers and interpreters)**

LANGUAGE PROCESSORS (TRANSLATORS)
These are programs used to translate high level programming languages to low level languages that processors can understand.

i) Compilers
- These translate a program written in a high level language into machine code language.
- The entire program is translated into machine code at once.

ii) Assemblers
- These translate a low level language (assembly language) into machine code.

iii) Interpreters
- These translate source program, line by line while the program is running.
- This is done each time a program is executed. As a result, a program running under an interpreter runs very slowly compared to a compiled program.

iv) Linkers
- These programs combine compiled programs and determine where the program will be located in memory.

Examples of high level languages
a) COBOL
- It is an acronym for Common Business Oriented Language.
- It was a high level language widely used in business
- It was produced to enable efficient software to be produced for business applications.

Examples of programs written in COBOL include; **payroll, accounting and stock control.**
- It uses English – like statements.

Advantages of COBOL

- ✓ It is fairly easy to understand.
- ✓ It can be used on different types of computers.
- ✓ It enables programmers to easily re – arrange records within a file.
- ✓ It enables programmers to easily produce reports.

Disadvantages of COBOL

- Coding is lengthy and tiresome to make.
- It takes longer to learn

b) BASIC (Beginners All Purpose Symbolic Instruction Code)

It was developed in 1964 by John Kemeny and Thomas Kutz to teach students how to use computers.

Advantages of BASIC

- ✓ It is easy to learn and use.
- ✓ It is so popular
- ✓ Several books exist that are used as self – teaching manuals.

Disadvantages of BASIC

- It is not a standard language
- There are many different versions of BASIC with so little compatibility between them.

c) FORTRAN (Formula TRANslation)

It was developed in 1956 by IBM to provide an easier way of writing scientific and engineering applications because of its simplicity, conciseness, standardization, efficiency and numerical precision.

Advantages of FORTRAN

- ✓ It is widely accepted and understood.
- ✓ It is easy to write a simple FORTRAN program.
- ✓ It includes mathematical functions that are good for solving problems.

Disadvantages of FORTRAN

- It is difficult to use it for other applications other than scientific and engineering applications.
- Input and output operations cannot be accomplished easily.
- Difficult to read reports and screen displays.

d) PASCAL

- It was named in remembrance of the inventor of the **mechanical adding calculator, Pascal Blaise.**
- It was developed to teach the concepts of structured programming.

Advantages of Pascal

- ✓ It reinforces the principles of structured programming.
- ✓ It is not limited to business or scientific applications.

e) ADA

- It was developed and named in honor of **Lady Augusta Lovelance Ada.**
- It was developed for the U.S department of defense to improve software reliability, portability and maintainability.

f) LISP (List Processing)

- It was developed in the late 1950s by John McCarthy of M.I.T.
- It is the prominent language used in artificial intelligence.
- Both programs and data are sorted as lists.

- Not suitable for commercial data processing.
- It is not widely available or known by many programmers.

g) LOGO

- It was developed for educational use.
- It could allow children to explore and develop concepts through programming the movement of a ―turtle‖ or pen.
- It has no commercial purpose.

h) ALGOL (Algorithmic Language)

It is suitable for scientific and engineering computations.

i) C

- It is a high level language
- It is the most portable general purpose language
- Derivatives of C are; C+, C++

j) PL/1 (Programming Language 1)

- It was developed for mainframe computers
- It is suitable for both scientific and commercial work.

k) PL/M (Programming Language Microcomputer);

- It was developed purposely for use with the Intel Microcomputers.
- It has a compiler.

l) APL (AProgramming Language)

3. Fourth generation Languages (4GLs / Application generators / program generators)

- Are languages designed to make the process of creating a computer – based application easier by doing the programming themselves.
- The user defines certain tasks and then the application generators will create the program code that will perform the tasks that have been defined.

Examples of 4GLs

- **Structured Query Language**

4. Artificial Intelligence Languages (Fifth Generation Languages / 5GLs)

- These are languages used in intelligent knowledge based systems (IKBs) such as robots.
- They ―think‖ and reason like human beings because of the programs installed on them.
- They are extremely used in artificial intelligence projects like space exploration.

5. Web development languages

- These include HTML and JAVA
- HTML (Hypertext Markup Language) is one of the programming languages used to create web pages for the internet and intranets.
- JAVA is an Object Oriented Programming (OOP) language that resembles a simplified form of C++.
- Object Oriented Programming (OOP) uses objects which combine data and behavior.
- OOP enables rapid program development. Examples include; **Visual Basic.**

3.2.2. APPLICATION SOFTWARE

Application software are programs that perform specific tasks for users.

Or

They are programs designed to enable a computer to do a particular job.

Types of Application software

1. Off - shelf software (general purpose software)
2. Customized software (special purpose software)

1. **OFF – SHELF SOFTWARE (general purpose software)**

These are software programs ready to run when purchased.
Examples;
- ✓ **MS-Office suite**, e.g. word processors, spreadsheets, presentation software etc.
- ✓ **Computer games** e.g. chess, cross word puzzle, etc.
- ✓ **Education software** e.g. Encarta,

2. **CUSTOMISED SOFTWARE (specialized software)**

These are **tailor made** software which are developed at a user‘s request to perform specific functions.
Examples;
- ✓ Locally made school management systems(SMS),
- ✓ Inventory management systems.
- ✓ Payroll management systems
- ✓ Library management system

NB:
A cross platform application
Is one that runs identically on multiple operating systems.
An Application Service Provider (ASP)
Is a third party organization that manages and distributes software and services on the web
Other terms related to application software
- Packaged software: is a commercial software which is copyrighted and designed to meet the needs of a wide variety of users.

- Custom software: is a tailor made software developed at a user‘s request to perform specific functions.

- Freeware: is copyrighted software provided at no cost to users.

- Shareware: is copyrighted software that is distributed free for a trial period and payment is required for using the software beyond that trial period.

- Public domain software: is a free software and has no copyright restrictions.

CHARACTERISTICS OF APPLICATION PACKAGES
i. They are targeted to a wide range of users.

ii. They are user friendly (easy to use)

iii. They are generally developed for flexibility.

iv. They should be machine independent (they are designed to work on a range of computers and can be transferred from one computer to another with ease)

v. They are menu driven i.e. the user takes a choice out of a number of options.

EXAMPLES OF APPLICATION SOFTWARE
- Word processing software
- Spreadsheet software
- Database software
- Presentation software
- Desktop publishing software
- Accounting software
- Paint and image editing software
- Web page authoring software
- Video and audio editing software
- Educational software
- Entertainment software

 Communications software

e.t.c