FACULTY NAME:J.VIJAY SATHIARAJ
DESIGNAION:GUEST LECTURER
DEPARTMENT:GEOGRAPHY
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SEMESTER:III
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Introduction: Definition - Information Systems – Basic components of a computer System – Memory - Types of Computer Memory – Need Of Computer Software - Types of Software's – System Software and Its Types, Application Software – Programming languages – Language Processors.

INTRODUCTION- The term computer is derived from the Latin word compute, which means to calculate. A computer is an electronic machine, devised for performing calculations and controlling operations that can be expressed either in logical or numerical terms. In simple terms, a computer is an electronic device that performs diverse operations with the help of instructions to process the information in order to achieve the desired results. Computer application extends to cover huge area including education, industries, government, medicine, scientific research etc. A computer is one of the most influential forces available in modern times. Due to its memory, high speed and perfection, its application can be extended to almost infinite levels. Millions of complex calculations can be done in mere fraction of time. Difficult decisions can be made with accuracy for comparatively little cost. Computers are widely seen as instruments for future progress and as tools to achieve substantiality by way of improved access to information by means of video conferencing and e-mail. Indeed computers have left such on impression on modern civilization that we call this era as the information age.

CHARACTERSTICS OF COMPUTERS

The main characteristics of computers are: • Speed • Storage • Accuracy • Versatility • Automation • Diligence • Relability

SPEED -Computers are capable of carrying out the task with enormous speed. Today's computers, according to their class, can perform from 4 MIPS (Millions of instructions per second) to 100 MIPS. What may take days for manual calculations may take only a few hours for computers to perform. Inside the computer the information signal travels at incredible electronic speed.

STORAGE- Computers can store enormous quantity of information. Which is expressed in terms of Kilobytes (or) Mega Bytes (MB) or Gega Bytes (GB). It is achieved through its 'Main memory' or 'Primary storage' and through 'auxiliary storage' or 'Secondary storage'. The Hard disks Floppy disk, Compact Disc(CD) and Magnetic Tape storage are examples of secondary storages. These large volumes of storage occupy much lesser space compared to paper documents and this aspect of computers makes them more powerful.

ACCURACY -The accuracy of a Computer is consistently high. In fact, this quality of the computers make them indispensable in various fields such as Scientific Research, Space Research, Weather Predictions and many other areas where precision of a high ordered required.

VERSATILITY-- Computers are versatile in that they can perform almost any task, provided they are given the appropriate logical steps. For example, they are capable of performing wide ranging tasks such as construction of a payroll, inventory management in a factory, hotel billing, hospital management, banking applications and any imaginable task in every walk of life.

AUTOMATION-- The biggest advantage of computers is that it is automatic in its operation. Once a programming logic is initiated the computer performs repeated operations without human interventions until program completion.

DILIGENCE-- Computers are machines and that do not get tired or 'lose concentration' like human beings. If a large number of calculations say million calculations are to be performed the resultant output will remain exactly the same even if operations are repeated any number of times. But when a human being is asked to do the same job this consistency cannot be achieved. Thus for those who want consistent and continuous standard output, computer's 'diligence' is of great help.

RELIABILITY-- The computers give very accurate results with predetermined values. They correct and modify the parameters automatically, giving suitable signals. They give formatted results with high degree of precisions.

Definition - Information Systems

Information System Definition

"Information system is set of **people, information technology**, and **business process** in order to achieve a business objective."

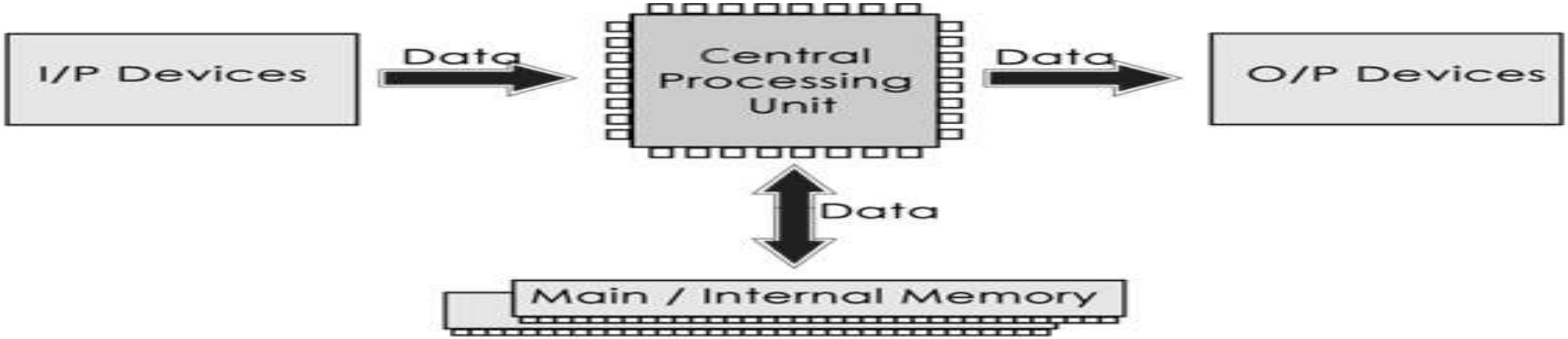
Information systems are a set of interconnected elements working together to collect, process, store, and distribute information to help coordination, visualization in an organization, analysis, and decision-making.

The Information system can be defined as a collection of **software, hardware**, and **telecommunications network** that people develop and use to **gather, create,** and **distribute useful data**, mainly in organizational settings.

In other words, an information system means a collection of interrelated components which work together to **gather, process, store,** and **break down** the information to help decision making.

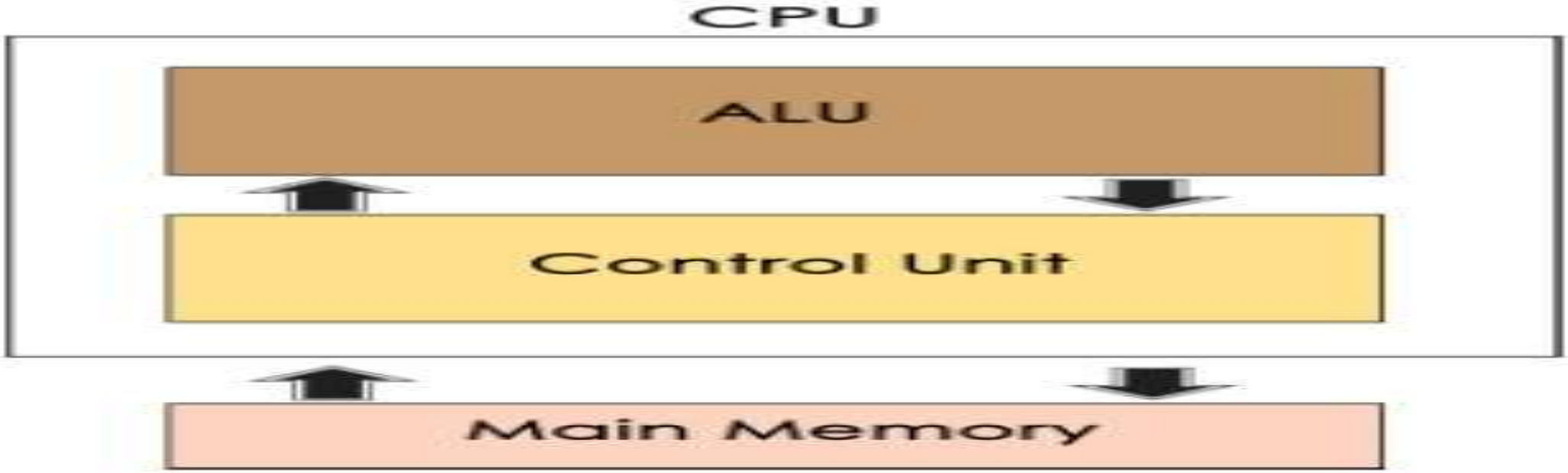
Components of Computer System

Computer systems consist of three components as shown in below image: **Central Processing Unit, Input devices and Output devices**. Input devices provide data input to processor, which processes data and generates useful information that's displayed to the user through output devices. This is stored in computer's memory.



Central Processing Unit

The Central Processing Unit (CPU) is called "the brain of computer" as it controls operation of all parts of computer. It consists of two components: Arithmetic Logic Unit (ALU), and Control Unit.



Arithmetic Logic Unit (ALU)

Data entered into computer is sent to RAM, from where it is then sent to ALU, where rest of data processing takes place. All types of processing, such as comparisons, decision-making and processing of non-numeric information takes place here and once again data is moved to RAM.

Control Unit

As name indicates, this part of CPU extracts instructions, performs execution, maintains and directs operations of entire system.

Functions of Control Unit

Control unit performs following functions −

•It controls all activities of computer

•Supervises flow of data within CPU

•Directs flow of data within CPU

•Transfers data to Arithmetic and Logic Unit

•Transfers results to memory

•Fetches results from memory to output devices

Memory Unit

This is unit in which data and instructions given to computer as well as results given by computer are stored. Unit of memory is "Byte".

1 Byte = 8 Bits

Memory

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells

Memory is primarily of three types −

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

Advantages

The advantages of cache memory are as follows −

•Cache memory is faster than main memory.

•It consumes less access time as compared to main memory.

•It stores the program that can be executed within a short period of time.

•It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows −

•Cache memory has limited capacity.

•It is very expensive.

Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than the main memory. These are used for storing data/information permanently. CPU directly does not access these memories, instead they are accessed via input-output routines. The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

Access time in RAM is independent of the address, that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup Uninterruptible Power System (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types −

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

ROM(READ ONLY MEMORY)

ROM stands for **Read Only Memory**. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as **bootstrap**. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

PROM (Programmable Read Only Memory)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM (Erasable and Programmable Read Only Memory)

EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is retained for more than 10 years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window (lid). This exposure to ultra-violet light dissipates the charge. During normal use, the quartz lid is sealed with a sticker.

EEPROM (Electrically Erasable and Programmable Read Only Memory)

EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

Advantages of ROM

The advantages of ROM are as follows −

•Non-volatile in nature

•Cannot be accidentally changed

•Cheaper than RAMs

•Easy to test

•More reliable than RAMs

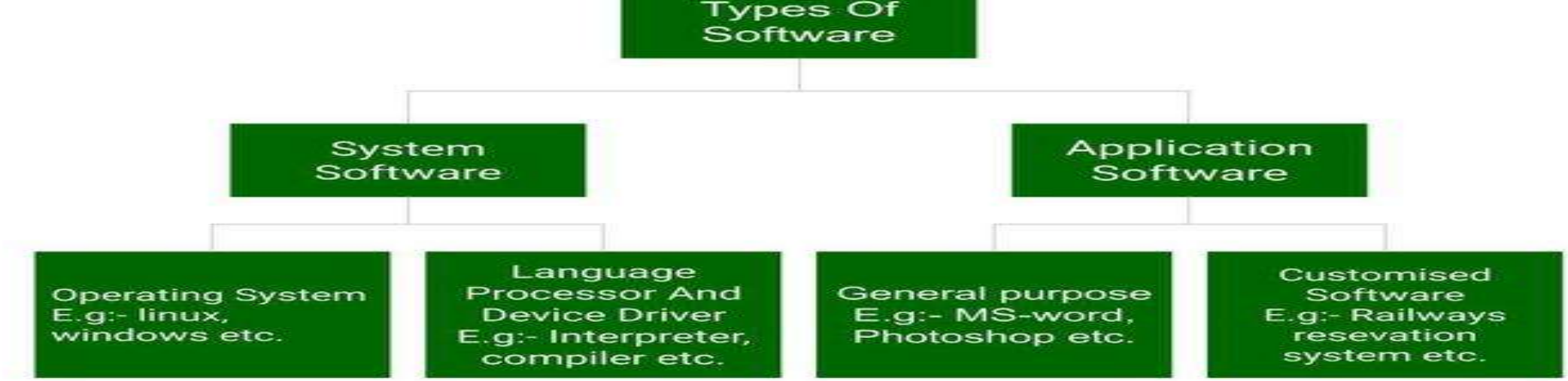
•Static and do not require refreshing

Software and its Types

Software is a collection of instructions, data, or computer programs that are used to run machines and carry out particular activities. It is the antithesis of hardware, which refers to a computer's external components. A device's running programs, scripts, and applications are collectively referred to as "software" in this context.

What is a Software?

In a computer system, the software is basically a set of instructions or commands that tell a computer what to do. In other words, the software is a computer program that provides a set of instructions to execute a user's commands and tell the computer what to do. For example like MS-Word, MS-Excel, PowerPoint, etc.



Above is the diagram of types of software. Now we will briefly describe each type and its subtypes:

1.System Software

1. Operating System
2. Language Processor
3. Device Driver

2.Application Software

2. General Purpose Software
3. Customize Software
4. Utility Software

System Software

System software is software that directly operates the computer hardware and provides the basic functionality to the users as well as to the other software to operate smoothly. Or in other words, system software basically controls a computer's internal functioning and also controls hardware devices such as monitors, printers, and storage devices, etc. It is like an interface between hardware and user applications, it helps them to communicate with each other because hardware understands machine language(i.e. 1 or 0) whereas user applications are work in human-readable languages like English, Hindi, German, etc. so system software converts the human-readable language into machine language and vice versa.

Types of System Software

It has two subtypes which are:

1.Operating System: It is the main program of a computer system. When the computer system ON it is the first software that loads into the computer's memory. Basically, it manages all the resources such as computer memory, CPU, printer, hard disk, etc., and provides an interface to the user, which helps the user to interact with the computer system. It also provides various services to other computer software. Examples of operating systems are Linux, Apple macOS, Microsoft Windows, etc.

2.Language Processor: As we know that system software converts the human-readable language into a machine language and vice versa. So, the conversion is done by the language processor. It converts programs written in high-level programming languages like Java, C, C++, Python, etc(known as source code), into sets of instructions that are easily readable by machines(known as object code or machine code).

3.Device Driver: A device driver is a program or software that controls a device and helps that device to perform its functions. Every device like a printer, mouse, modem, etc. needs a driver to connect with the computer system eternally. So, when you connect a new device with your computer system, first you need to install the driver of that device so that your operating system knows how to control or manage that device.

Features of System Software

Let us discuss some of the features of System Software:

- System Software is closer to the computer system.
- System Software is written in a low-level language in general.

•System software is difficult to design and understand.

•System software is fast in speed(working speed).

•System software is less interactive for the users in comparison to application software.

Application Software

Software that performs special functions or provides functions that are much more than the basic operation of the computer is known as application software. Or in other words, application software is designed to perform a specific task for end-users. It is a product or a program that is designed only to fulfill end-users' requirements. It includes word processors, spreadsheets, database management, inventory, payroll programs, etc.

Types of Application Software

There are different types of application software and those are:

1.General Purpose Software: This type of application software is used for a variety of tasks and it is not limited to performing a specific task only. For example, MS-Word, MS-Excel, PowerPoint, etc.

2.Customized Software: This type of application software is used or designed to perform specific tasks or functions or designed for specific organizations. For example, railway reservation system, airline reservation system, invoice management system, etc.

3.Utility Software: This type of application software is used to support the computer infrastructure. It is designed to analyze, configure, optimize and maintains the system, and take care of its requirements as well. For example, antivirus, disk fragmenter, memory tester, disk repair, disk cleaners, registry cleaners, disk space analyzer, etc.

Features of Application Software

•An important feature of application software is it performs more specialized tasks like word processing, spreadsheets, email, etc.

•Mostly, the size of the software is big, so it requires more storage space.

•Application software is more interactive for the users, so it is easy to use and design.

•The application software is easy to design and understand.

•Application software is written in a high-level language in general.

Programming Languages

Programming Language –

Introduction A programming language is a set of symbols, grammars and rules with the help of which one is able to translate algorithms to programs that will be executed by the computer. The programmer communicates with a machine using programming languages. Most of the programs have a highly structured set of rules.

The primary classifications of programming languages are:

Machine Languages.

Assembly Languages.

High level Languages.

Machine Language-- Machine language is a collection of binary digits or bits that the computer reads and interprets. Machine language is the only language a computer is capable of understanding. Machine level language is a language that supports the machine side of the programming or does not provide human side of the programming. It consists of (binary) zeros and ones. Each instruction in a program is represented by a numeric code, and numerical addresses are used throughout the program to refer to memory locations in the computer's memory. Microcode allows for the expression of some of the more powerful machine level instructions in terms of a set of basic machine instructions.

Assembly language-- Assembly language is easier to use than machine language. An assembler is useful for detecting programming errors. Programmers do not have the absolute address of data items. Assembly language encourage modular programming.

High level language-- High level language is a language that supports the human and the application sides of the programming. A language is a machine independent way to specify the sequence of operations necessary to accomplish a task. A line in a high level language can execute powerful operations, and correspond to tens, or hundreds, of instructions at the machine level. Consequently more programming is now done in high level languages. Examples of high level languages are BASIC, FORTRAN etc

Language Processors: Assembler, Compiler and Interpreter

Computer programs are generally written in high-level languages (like C++, Python, and Java). A language processor, or language translator, is a computer program that convert source code from one programming language to another language or to machine code (also known as object code). They also find errors during translation.

What is Language Processors?

Compilers, interpreters, translate programs written in high-level languages into machine code that a computer understands and assemblers translate programs written in low-level or assembly language into machine code. In the compilation process, there are several stages. To help programmers write error-free code, tools are available.

Assembly language is machine-dependent, yet mnemonics used to represent instructions in it are not directly understandable by machine and high-Level language is machine-independent. A computer understands instructions in machine code, i.e. in the form of 0s and 1s. It is a tedious task to write a computer program directly in machine code. The programs are written mostly in high-level languages like Java, C++, Python etc. and are called source code. These source code cannot be executed directly by the computer and must be converted into machine language to be executed. Hence, a special translator system software is used to translate the program written in a high-level language into machine code is called Language Processor and the program after translated into machine code (object program/object code).

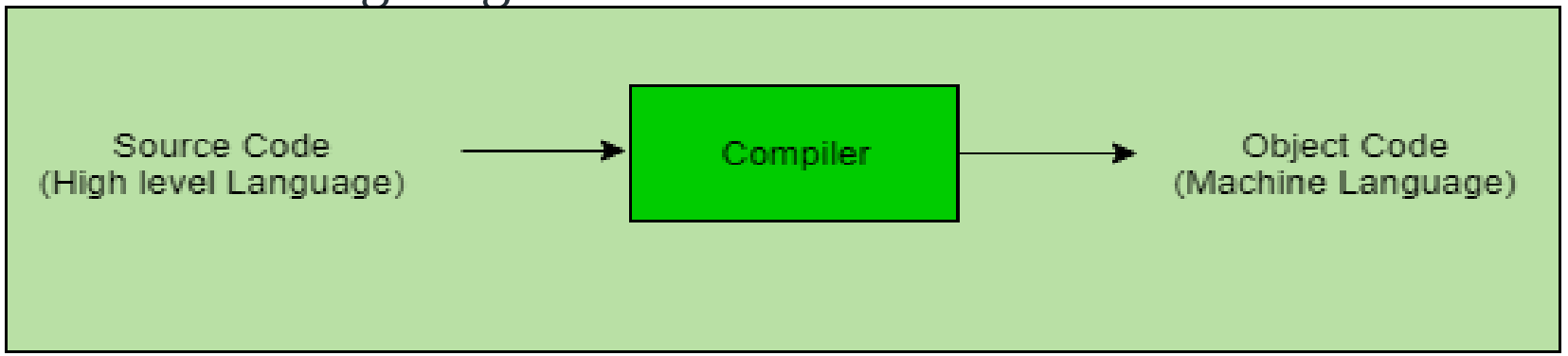
Types of Language Processors

The language processors can be any of the following three types:

Compiler

The language processor that reads the complete source program written in high-level language as a whole in one go and translates it into an equivalent program in machine language is called a Compiler. Example: C, C++, C#.

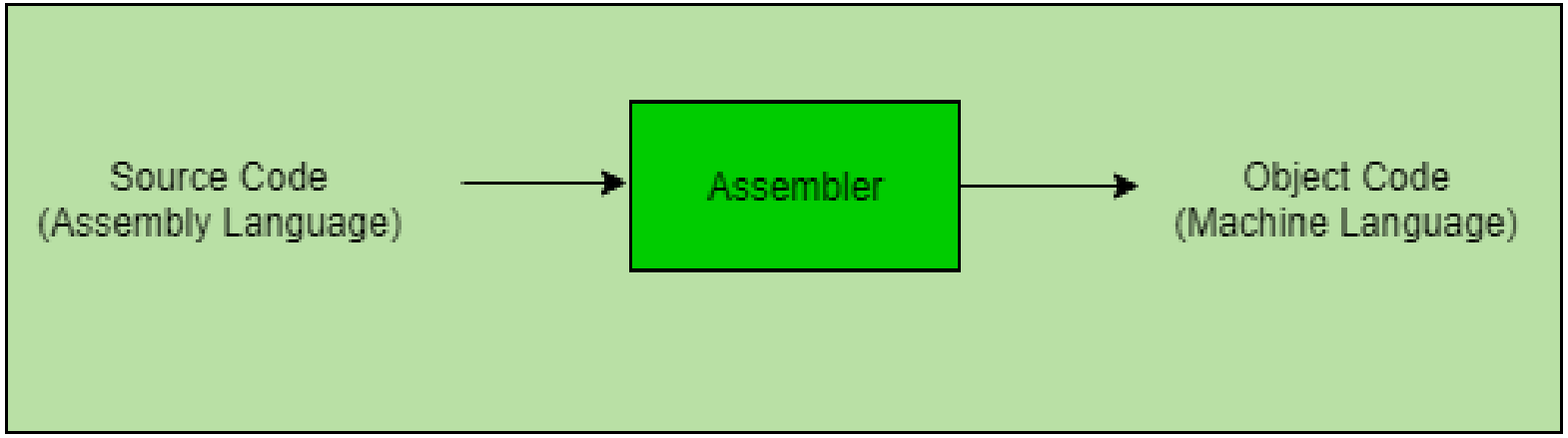
In a compiler, the source code is translated to object code successfully if it is free of errors. The compiler specifies the errors at the end of the compilation with line numbers when there are any errors in the source code. The errors must be removed before the compiler can successfully recompile the source code again the object program can be executed number of times without translating it again.



Assembler

The Assembler is used to translate the program written in Assembly language into machine code. The source program is an input of an assembler that contains assembly language instructions. The output generated by the assembler is the object code or machine code understandable by the computer. Assembler is basically the 1st interface that is able to communicate humans with the machine. We need an assembler to fill the gap between human and machine so that they can communicate with each other. code written in assembly language is some sort of mnemonics(instructions) like ADD, MUL, MUX, SUB, DIV, MOV and so on. and the assembler is basically able to convert these mnemonics in binary code. Here, these mnemonics also depend upon the architecture of the machine.

For example, the architecture of intel 8085 and intel 8086 are different.



Interpreter

The translation of a single statement of the source program into machine code is done by a language processor and executes immediately before moving on to the next line is called an interpreter. If there is an error in the statement, the interpreter terminates its translating process at that statement and displays an error message. The interpreter moves on to the next line for execution only after the removal of the error. An Interpreter directly executes instructions written in a programming or scripting language without previously converting them to an object code or machine code. An interpreter translates one line at a time and then executes it.

Example: Perl, Python and Matlab.