



Certified C++ Developer
Sample Material
VS-1249

Vskills Certifications

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1. OBJECT-ORIENTED PROGRAMMING BASICS

1.1. Computer and Software Basics

All computer systems perform the following 5 basic operations

Input

The process of entering the data and instruction into computer system. It involves three steps - accepting the list of instruction from user in their format. Then converting these instructions in computer acceptable form. Supplying the instructions to computer system for processing.

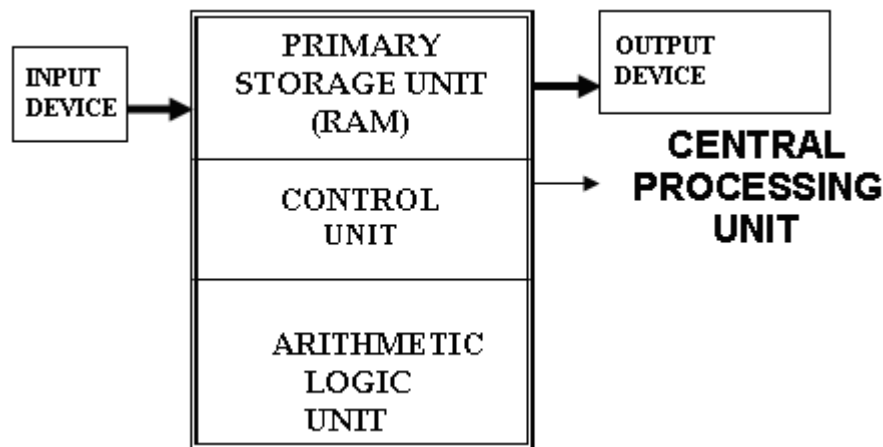
Process

It is the actual processing in the CPU that takes place on the data, as per the given instructions.

Output

The process of output of the data from the computer system. It accepts the results produced by computer, which are in coded form. It converts the coded form to human acceptable form. It supplies the converted results to user.

Block Diagram of a Computer



Software

As, we earlier noted that software is instructions, programs for the computer, but there are various types of software. Software can be classified as

System Software

Software which control the operation of a computer system. They directly interface with the hardware of the computer system. They provide a platform over which application software runs. It controls the execution of application programs. For example Operating System like MS-DOS, MS-WINDOWS XP/ 2003, LINUX

Operating System Software - It is a type of system software. It is a master program which runs in the computer and controls the hardware and running of the application software. It is the software,

which is loaded into the memory first, when a computer is started. The operating system manages the data in the computer system, various jobs or task assigned to it and is responsible for the security and proper functioning of the computer. Every general-purpose computer must have an operating system to run other programs. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. LINUX, Windows XP/2003, MS-DOS are common examples of operating system.

The major functions of an Operating System are

- ✓ Resource management - The resource management function of an OS allocates computer resources such as CPU time, main memory, secondary storage, and input and output devices for use.
- ✓ Data management - The data management functions of an OS govern the input and output of the data and their location, storage, and retrieval.
- ✓ Task management - The Task management function of an OS prepares, schedules, controls, and monitors jobs submitted for execution to ensure the most efficient processing. A job is a collection of one or more related programs and their data.
- ✓ Command Interpretation - The OS establishes a standard means of communication between users and their computer systems. It does this by providing a user interface (Graphical based as in Windows or Character based as in DOS) and a standard set of commands that control the hardware.

Some of the typical uses of an Operating System are

- ✓ 1. Executing application programs.
- ✓ 2. Formatting floppy or hard or flash disk.
- ✓ 3. Setting up directories to organize your files.
- ✓ 4. Displaying a list of files stored on a particular disk.
- ✓ 5. Verifying that there is enough room on a disk to save a file.
- ✓ 6. Protecting and backing up your files by copying them to other disks for safekeeping.

Device Drivers - A device driver is a program that controls a particular type of device that is attached to computer. There are device drivers for printers, displays, CD-ROM readers, diskette drives, and so on. When you buy an operating system, many device drivers are built into the product. However, if you later buy a new type of device that the operating system didn't anticipate, you'll have to install the new device driver. A device driver essentially converts the more general input/output instructions of the operating system to messages that the device type can understand. In Windows operating systems, a device driver file usually has a file name suffix of DLL or EXE. A virtual device driver usually has the suffix of VXD.

Application Software

These types of software fulfill a specific user's requirement. They run over the system software. Application programmers develop the application software. They carry out operation for a specific application. For example accounting software, word processor software, etc. Some of application packages are

Word Processing Software - This software is used to create and to edit documents such as letters, reports, essays etc. The word processing software provides several features for document editing

and formatting. In editing process, text is entered into the document, deleted, copied or moved to another location etc. In formatting process, different formats can be applied on the text to make the document more attractive before to print on the printer. The most popular word processing software programs are Microsoft Word, Word Perfect etc.

Spreadsheet Software - Spreadsheet software is used to store and process data in an electronic sheet having columns and rows. The data is entered into the cells of the sheet. The intersection of a row and a column is known as cell. Each cell is a unique address. The numbers and formulas are entered into the cells and the computer can automatically perform the calculation on numerical data in cells. The spreadsheet software is commonly used for business application such as for performing financial calculations and recording transactions. The most popular example of spreadsheet software is Microsoft Excel etc.

Database Management Software - Database management software is used to create and manage databases. A database is a collection of related information or records on any subject such as records of the books in a library, information about the students of a college etc. Database Management Software stores and manages records in databases. These records can be accessed very quickly when required. The Microsoft Access, Oracle etc. are most popular examples of Database Management Software.

Presentation Graphics Software - The presentation graphic software is used to create slides for making presentations. The presentation graphic software also has pre-drawn clip art images, which can be inserted into slides and can be modified. The PowerPoint is an example of presentation graphic software.

Communication Software - The Communication software is used to exchange information electronically. It is most commonly used software to send and receive information on the Internet. It also allows for sending and receiving faxes directly. The computer files can also be transferred from one PC to another through this software. The Internet Explorer is an example of this software.

Other Software

Utility software - This software is a kind of system software designed to help analyze, configure, optimize and maintain the computer. A single unit of utility software is usually called a utility or tool. They are often rather technical and targeted at people with an advanced level of computer knowledge. Most utilities are highly specialized and designed to perform only a single task or a small range of tasks. However, there are also some utility suites that combine several features in one piece of software. Most major operating systems come with several pre-installed utilities. Disk defragmenter, disk cleanup, backup are common utilities of Windows.

Custom Made Software - Custom Made Software is the software, which is made for fulfillment of the user's requirement. Software programmers develop the software for the customer, as per the customer's needs.

Packaged Software - Off the shelf or packaged software is readymade software, which we purchase like a commodity.

Translators

A language translator or a language processor is a general term used for any assembler, compiler or other routine that accepts statements in one language and produces equivalent statements in another language. The language processor reads instructions in a language called source program and converts to other language usually in machine language, also called the executable program. Computers understand machine language which we humans do not understand hence, a translator between human and machine language is needed. Three types of translators are

Assembler - This is a program used to translate assembly language program to machine code. It was used earlier and is not widely used these days.

Compiler - A computer translates program written in high-level language into executable program. Compiler is more complex program than assembler or other system programs and hence they need more memory. The language processor translates the complete source program as a whole in machine code before execution. The C and C++ compilers are best examples of compilers.

Interpreter - It also translates high-level language into machine language. But unlike compilers it translates a statement in program and executes the statement immediately before to translate the next statement. When an error occurs in the program the program is halted and an error message is displayed. An interpreter does not generate a permanent saved object code file. Whenever a program is re-executed the translation process is repeated. The OWBASIC is an example of interpreter.

1.2. C++ Evolution

As object-oriented analysis, design, and programming began to catch on, Bjarne Stroustrup took the most popular language for commercial software development, C, and extended it to provide the features needed to facilitate object-oriented programming. He created C++, and in less than a decade it has gone from being used by only a handful of developers at AT&T to being the programming language of choice for an estimated one million developers worldwide. It is expected that by the end of the decade, C++ will be the predominant language for commercial software development.

While it is true that C++ is a superset of C, and that virtually any legal C program is a legal C++ program, the leap from C to C++ is very significant. C++ benefited from its relationship to C for many years, as C programmers could ease into their use of C++. To really get the full benefit of C++, however, many programmers found they had to unlearn much of what they knew and learn a whole new way of conceptualizing and solving programming problems.

The Accredited Standards Committee, operating under the procedures of the American National Standards Institute (ANSI), is working to create an international standard for C++. The draft of this standard has been published, and a link is available at www.libertyassociates.com.

The ANSI standard is an attempt to ensure that C++ is portable--that code you write for Microsoft's compiler will compile without errors, using a compiler from any other vendor.

Timeline

The work that led to C++ started in the fall of 1979 under the name “C with Classes.”

Here is a simplified timeline:

- ✓ 1979 Work on “C with Classes” started. The initial feature set included classes and derived classes, public/private access control, constructors and destructors, and function declarations with argument checking. The first library supported non-preemptive concurrent tasks and random number generators.
- ✓ 1984 “C with Classes” was renamed to C++. By then, C++ had acquired virtual functions, function and operator overloading, references, and the I/O stream and complex number libraries.
- ✓ 1985 First commercial release of C++ (October 14). The library included I/O streams, complex numbers, and tasks (nonpreemptive scheduling).
- ✓ 1985 The C++ Programming Language (“TC++PL,” October 14) [Stroustrup,1986].
- ✓ 1989 The Annotated C++ Reference Manual (“the ARM”).
- ✓ 1991 The C++ Programming Language, Second Edition [Stroustrup,1991], presenting generic programming using templates and error handling based on exceptions (including the “Resource Acquisition Is Initialization” general resource management idiom).
- ✓ 1997 The C++ Programming Language, Third Edition [Stroustrup,1997] introduced ISO C++, including namespaces, `dynamic_cast`, and many refinements of templates. The standard library added the STL framework of generic containers and algorithms.
- ✓ 1998 ISO C++ standard.
- ✓ 2002 Work on a revised standard, colloquially named C++0x, started.
- ✓ 2003 A “bug fix” revision of the ISO C++ standard was issued. A C++ Technical Report introduced new standard-library components, such as regular expressions, unordered containers (hash tables), and resource management pointers, which later became part of C++0x.
- ✓ 2006 An ISO C++ Technical Report on Performance was issued to answer questions of cost, predictability, and techniques, mostly related to embedded systems programming.
- ✓ 2009 C++0x was feature complete. It provided uniform initialization, move semantics, variadic template arguments, lambda expressions, type aliases, a memory model suitable for concurrency, and much more. The standard library added several components, including threads, locks, and most of the components from the 2003 Technical Report.
- ✓ 2011 ISO C++11 standard was formally approved.
- ✓ 2012 The first complete C++11 implementations emerged.
- ✓ 2012 Work on future ISO C++ standards (referred to as C++14 and C++17) started.
- ✓ 2013 The C++ Programming Language, Fourth Edition introduced C++11. During development, C++11 was known as C++0x. As is not uncommon in large projects, we were overly optimistic about the completion date.

1.3. C++ Program Translation

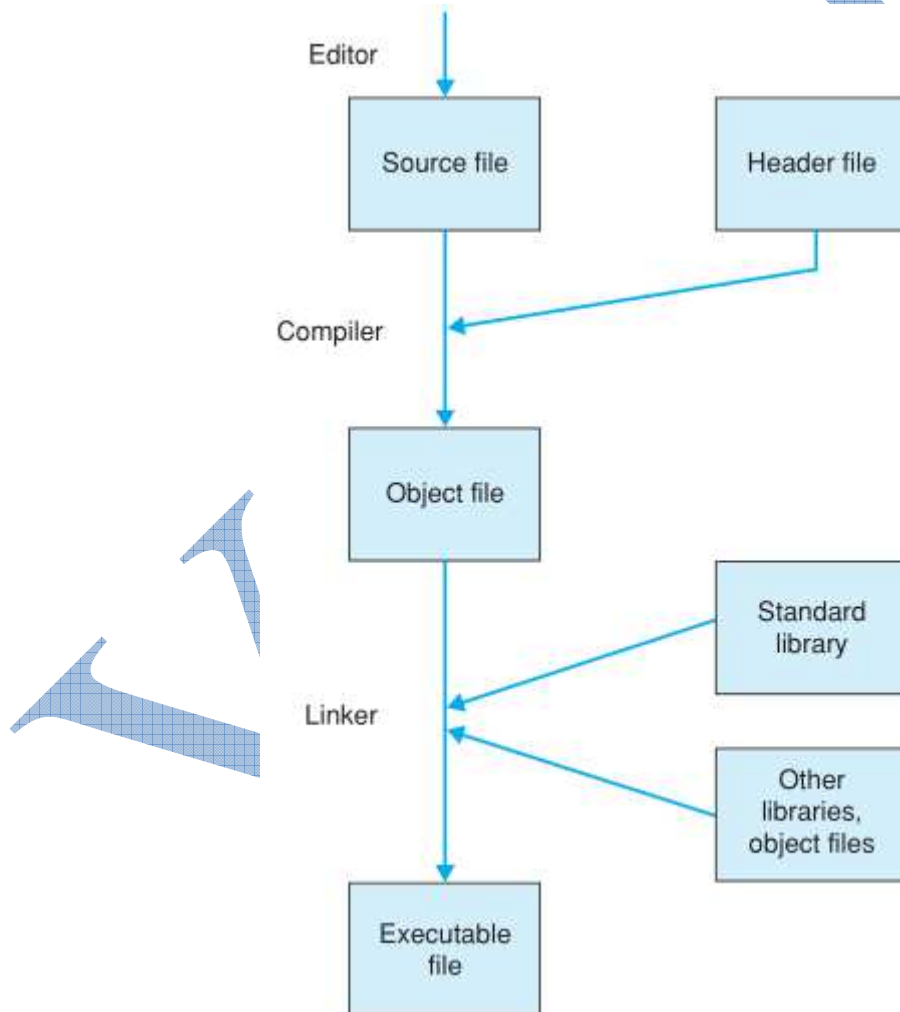
The following three steps are required to create and translate a C++ program:

- ✓ First, a text editor is used to save the C++ program in a text file. In other words, the source code is saved to a source file. In larger projects the programmer will normally use modular programming. This means that the source code will be stored in several source files that are edited and translated separately.

- ✓ The source file is put through a compiler for translation. If everything works as planned, an object file made up of machine code is created. The object file is also referred to as a module.
- ✓ Finally, the linker combines the object file with other modules to form an executable file. These further modules contain functions from standard libraries or parts of the program that have been compiled previously.

It is important to use the correct file extension for the source file's name. Although the file extension depends on the compiler you use, the most commonly found file extensions are .cpp and .cc.

Prior to compilation, header files, which are also referred to as include files, can be copied to the source file. Header files are text files containing information needed by various source files, for example, type definitions or declarations of variables and functions.



Header files can have the file extension .h , but they may not have any file extension. The C++ standard library contains predefined and standardized functions that are available for any compiler.

Modern compilers normally offer an integrated software development environment, which combines the steps mentioned previously into a single task. A graphical user interface is available for editing, compiling, linking, and running the application. Moreover, additional tools, such as a debugger, can be launched.

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