CSI33 Data Structures

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Outline

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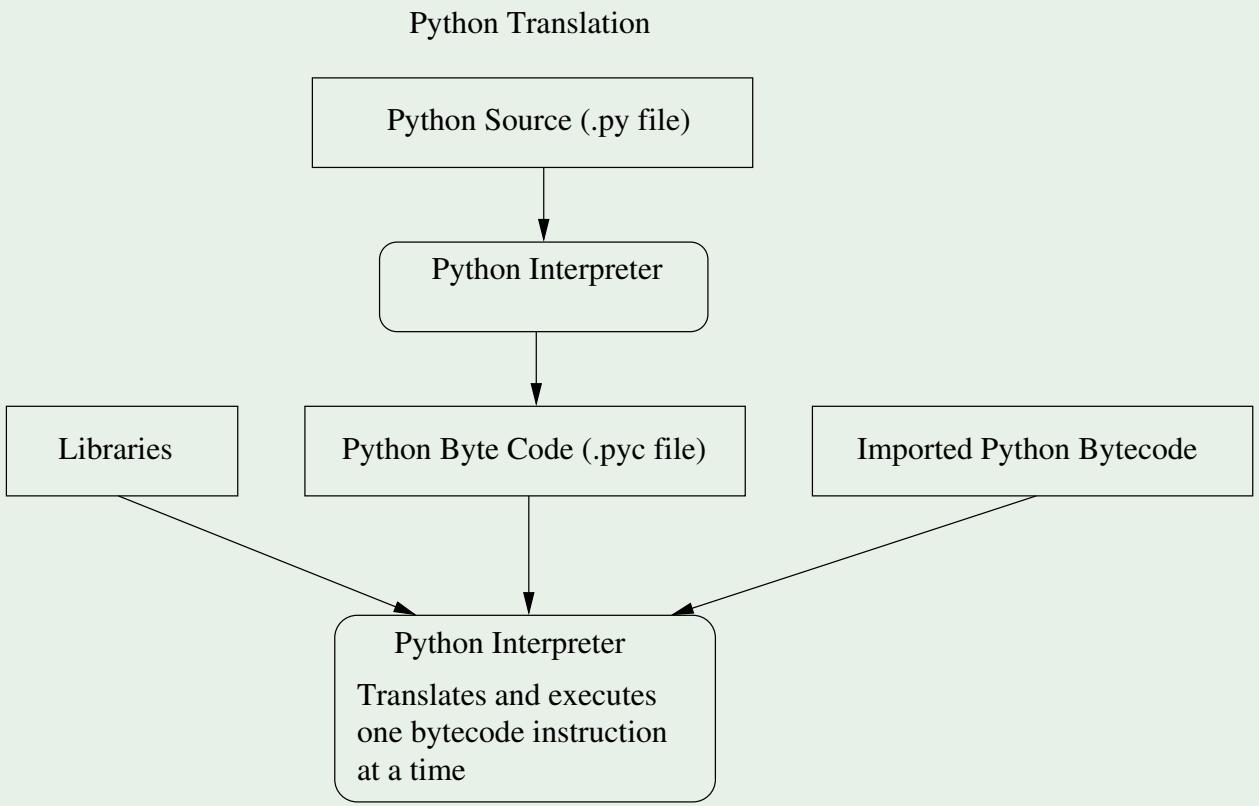
History

Early Languages - Ancestors of C++

- 1967 - BCPL (Martin Richards, Cambridge)
- 1969 - B (Thomson and Ritchie, AT&T)
- 1969 - UNIX Operating System (Kernigan, Ritchie and Thomson, AT&T)
- 1970 - C Language (Kernigan and Ritchie, AT&T)
- 1980 - C with Classes (Bjarne Stroustrup, AT&T)
- 1985 - C++ (Borland, Microsoft, IBM and AT&T)
- 1990 - Standard Template Library (STL)
- 1998 - ANSI standards established for C++

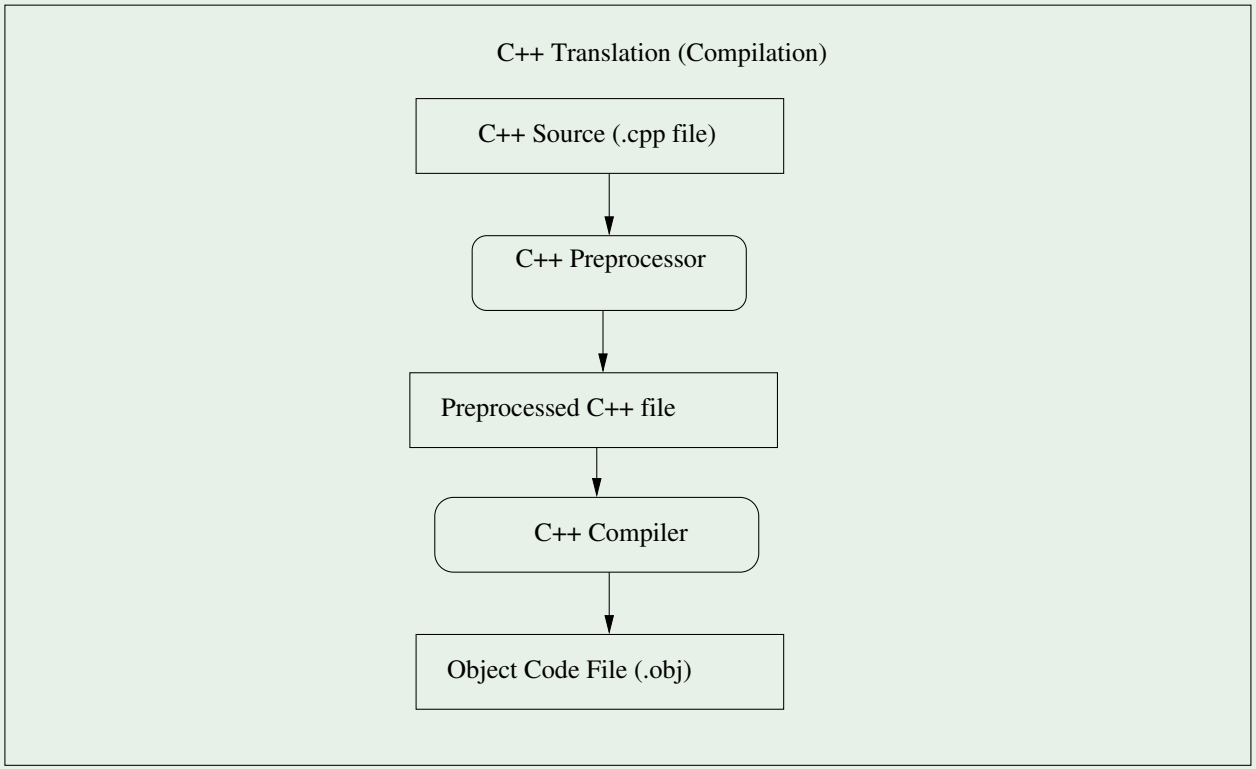
Python Translation Process

Interpretation



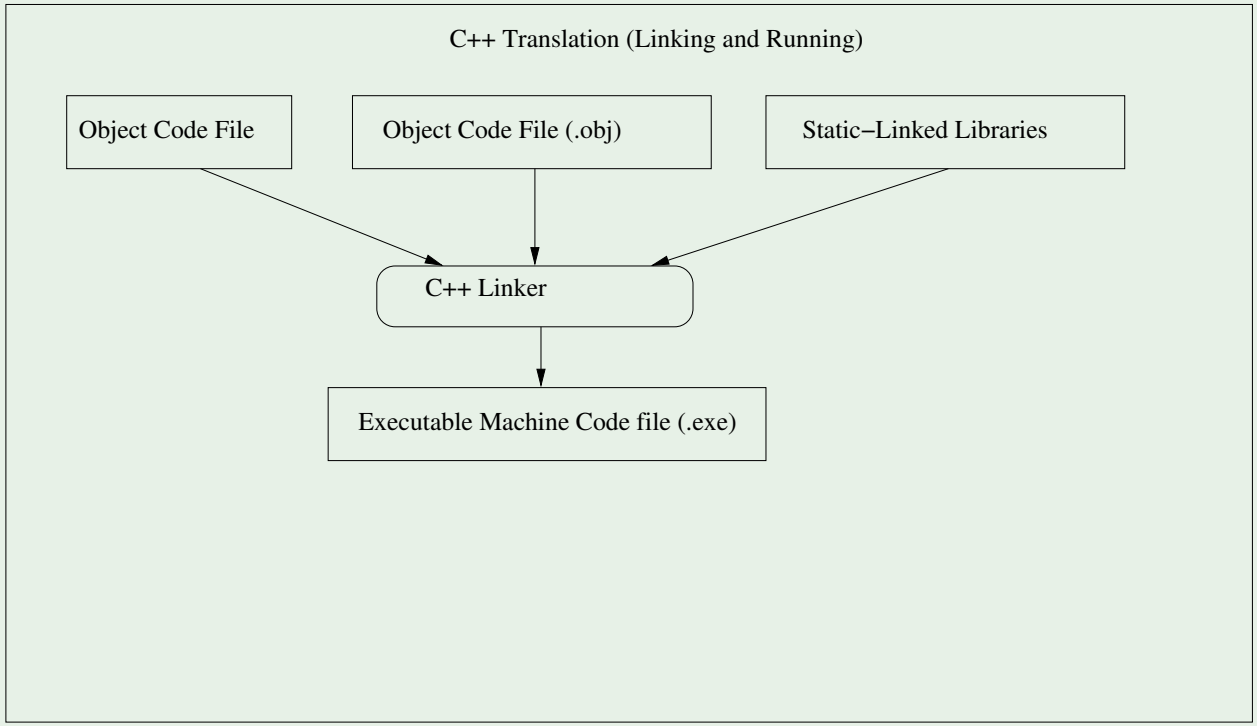
C++ Translation Process - "Building" a Program

Compilation



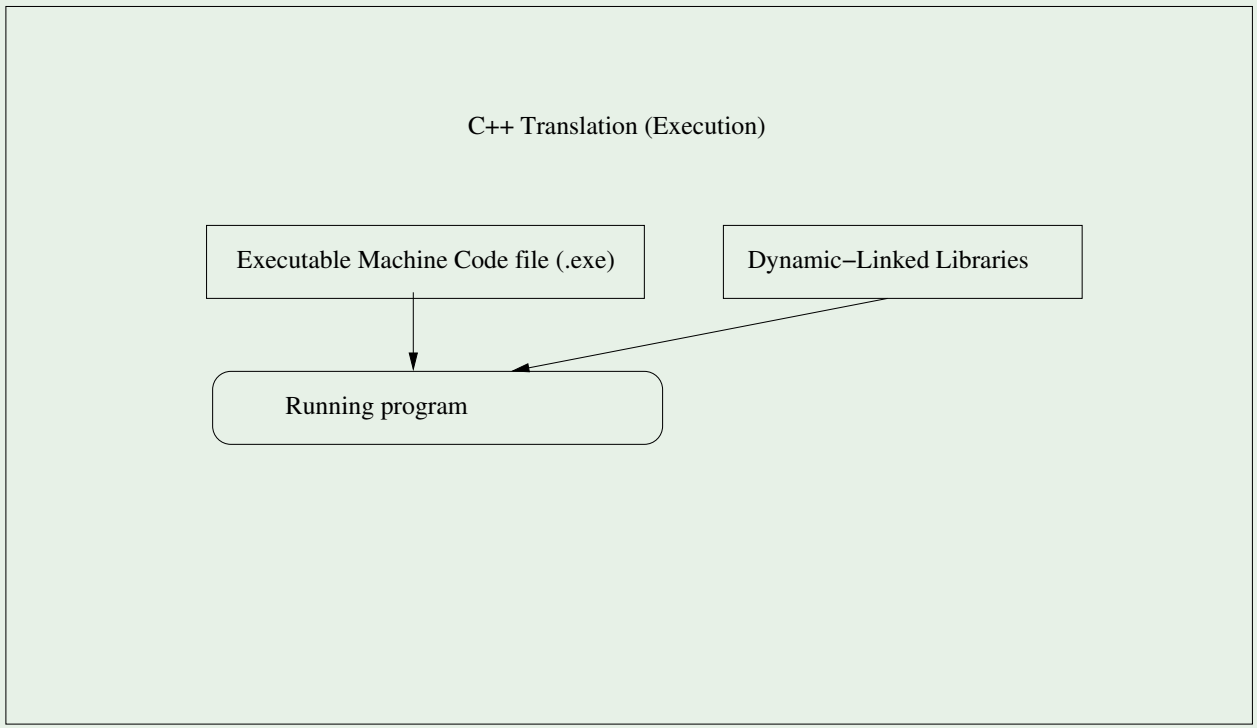
C++ Translation Process - "Building" a Program

Linking



C++ Translation Process - "Building" a Program

Execution



Comments

Single-Line Or Multiline

- A single-line comment begins with //
- A multiline comment begins with /* and ends with */

Whitespace and Blocks of Code

Whitespace

- Whitespace consists of spaces, tabs, and newline characters.
- C++ uses whitespace as a separator between keywords, identifiers, and operation symbols.
- There is no other special meaning for whitespace.
- Indentation is done for readability only–it is not used for the body of a function, a loop, or an if/else clause.

Blocks Of Code

Function Bodies

In C++, instead of indentation, function bodies and **if** clauses are specified by enclosing them in curly brace symbols { and }. The code inside a pair of braces is called a Code Block.

Identifiers And Keywords

Keywords

Words which have special meaning for C++ cannot be used as identifiers for variables, function names, or class names.

Identifiers And Keywords

Identifiers

An identifier can be any sequence of letters (uppercase or lowercase), decimal digits (0-9) or the underscore character "_", as long as the first character of the identifier is not a digit.

Data Types

Variables Hold Values (Not References)

In Python, every variable name uses a reference (a four-byte address), which can point to any type of data (int, str, or any object). The type of a variable can be changed by an assignment statement. Python is said to use dynamic typing.

Data Types

In C++, Declarations Are Required

In C++, every variable uses its actual value, so the compiler needs to know the type of data a variable will take, since different types occupy different amounts of memory. The compiler reserves as many bytes of memory as required for each declared variable, based on the data type specified in the declaration.

- int = 4 bytes: the declaration `int a;` allocates 4 bytes for a
- char = 1 byte: the declaration `char c;` allocates 1 byte for c
- double = 8 bytes: the declaration `double d;` allocates 8 bytes for d
- bool = 1 byte: the declaration `bool b;` allocates 1 byte for b

Include Statements

Include Statements in C++ Are Like Import Statements in Python

In C++, an `include` statement is used to copy the contents from another file into the file being translated. This is useful, for example, when the same variable is used in different C++ program files since its declaration can be written once and then included whenever that variable is used.

Namespaces

Namespaces Are Like Modules in Python

In Python, if a variable in one module has the same name as one in another module, the two variables are kept separate by Python, and can have different values.

In C++, declaring and naming a namespace (surrounded with braces) will cause every variable declared in the namespace to exist separately from any variable with the same name declared outside the namespace.

Input/Output

cin and cout

`cin` is an object in the `istream` class. Using the >> operator, it allows user input, from the keyboard, to become a variable's value:

```
cin >> a;
```

`cout` is an object in the `ostream` class. Using the << operator, it allows a variable's values to become output on the display console:

```
cout << a;
```

Input/Output

''Hello, world''

```
// hello.cpp
#include <iostream>
using namespace std;
int main()
{
   cout << "hello world\n";
   system("PAUSE");
   return 0;
}
```

Build

The make Utility

- A script (short program) which tells the computer to perform the steps of building an executable file:
- Preprocessing and compiling a `.cpp` file into an object(`.o`) file.
- Linking the object file with other machine code files to produce an executable (`.exe`) file.
- Only perform operations if the output file is older than the input file.

Build

Eclipse Console View

```
**** Build of configuration Debug for project HelloWorld ****
**** Internal Builder is used for build ****

g++ -O0 -g3 -Wall -c -fmessage-length=0 -ohello.o ..\hello.cpp
g++ -oHelloWorld.exe hello.o
Build complete for project HelloWorld
Time consumed:  2266 ms.
```