动 态 链 接 库

——Windows系统上的动态库

第八组报告

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动态库简介

- A brief introduction to dynamic library

静态库

Background Introduction

操作方式

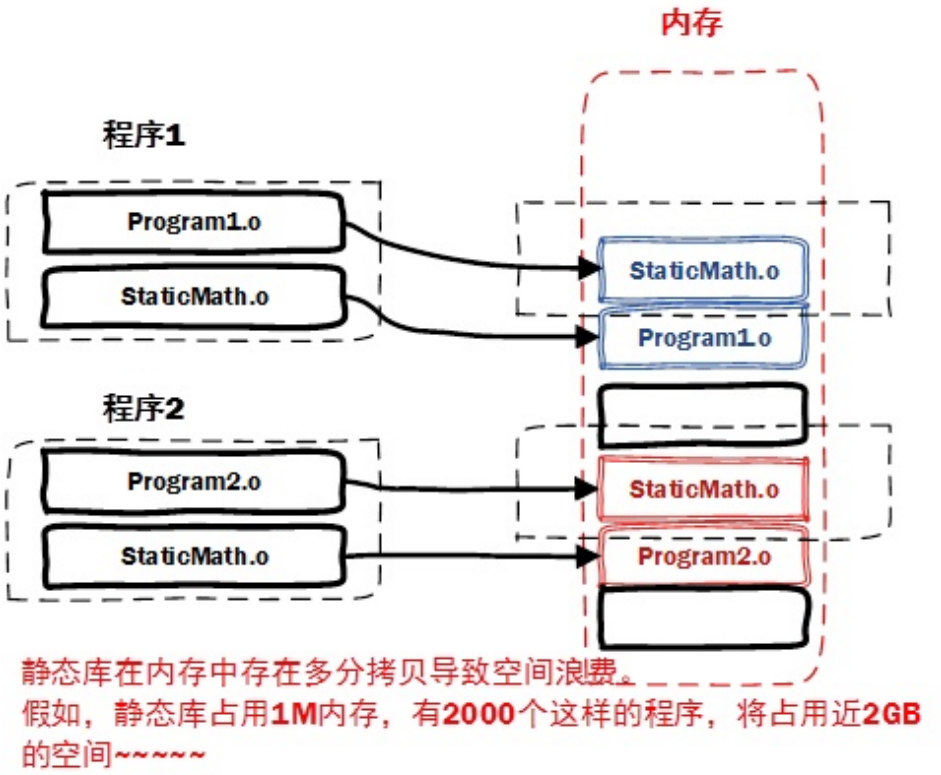
Operation Method

代码简单地附加到调用的程序上，在编译链接时直接将需要的执行代码拷贝到调用处

特征

Feature

静态方法会造成系统的内存开销较大，代码更新难度增加



需要一种方法能够增加代码的复用性

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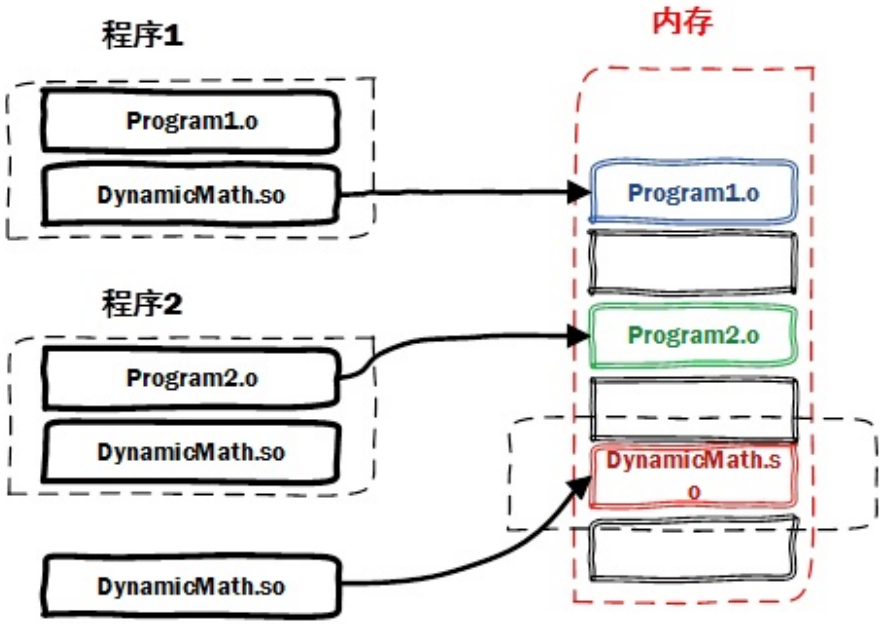
许多应用共享的代码能够切分到一个DLL中，在硬盘上存为一个文件，在内存中使用一个实例。

特征

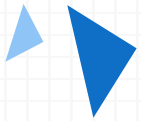
Feature

能够大幅降低计算机存储器浪费的情形，模块化开发

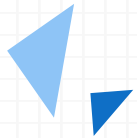


动态库在内存中只存在一份拷贝，避免了静态库浪费空间的问题。

动态链接库可以节约应用程序所需的磁盘和内存空间



Windows DLL



A brief introduction to windows DLL

Windows DLL

Dynamic Linking Library

Concept

The concept of DLL

Dynamic-link library (DLL) is Microsoft's implementation of the shared library concept in **the Microsoft Windows and OS/2 operating systems**.

Application of DLL

Windows system is built on DLL

For the Windows operating systems, much of the functionality of the operating system is provided by dynamic link libraries (DLL). **When you run a program on Windows operating systems**, much of the functionality of the program may be provided by DLLs.

DLL are the core of Windows architecture

基础介绍

Basic introduction

ActiveX Controls (.ocx) files: An example of an ActiveX control is a calendar control that lets you select a date from a calendar.

Control Panel (.cpl) files: An example of a .cpl file is an item that is located in Control Panel. Each item is a specialized DLL.

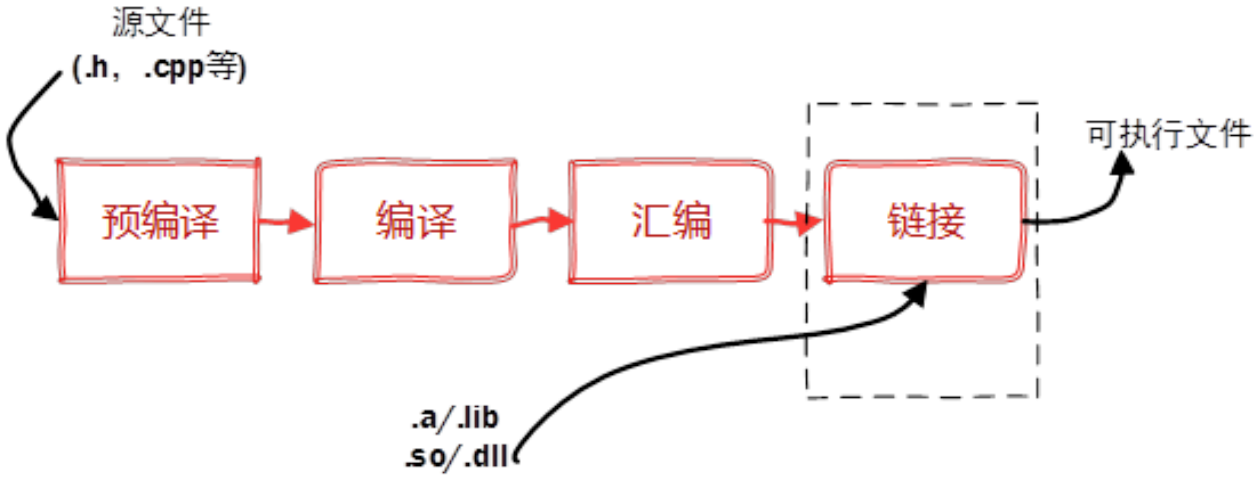
Device driver (.drv) files: An example of a device driver is a printer driver that controls the printing to a printer.

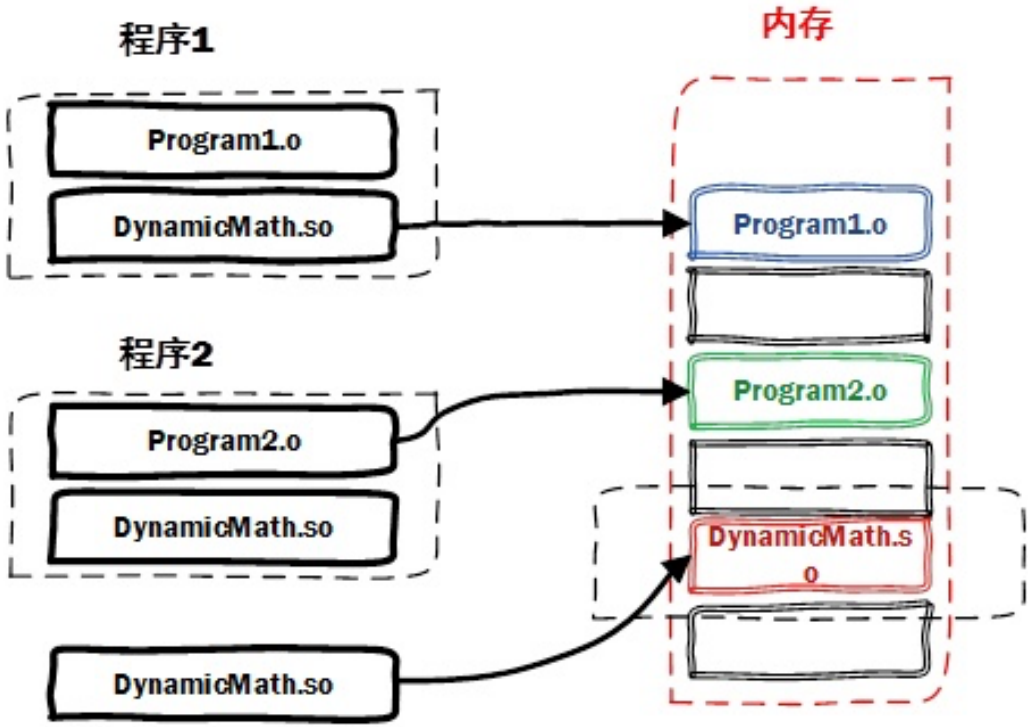
DELPHI

Delphi

Microsoft Visual Basic

C and C++


源文件
(.h，.cpp等)
预编译
编译
汇编
链接
可执行文件
.a/.lib
.so/.dll


程序1
Program1.o
DynamicMath.so
程序2
Program2.o
DynamicMath.so
DynamicMath.so
内存
Program1.o
Program2.o
DynamicMath.so

DLL调用

Loading of Dynamic Linking

装载时动态链接

Load-time Dynamic Linking

An application makes explicit calls to exported DLL functions like local functions. When you do this, the linker will provide the system with the information that is required to load the DLL and resolve the exported DLL function locations at load time.

运行时动态链接

Run-time Dynamic Linking

An application calls either the LoadLibrary function or the LoadLibraryEx function to load the DLL at run time. After the DLL is successfully loaded, you use the GetProcAddress function to obtain the address of the exported DLL function that you want to call.

程序依赖问题

The dependencies of DLL program

自动建立

When a program or a DLL uses a DLL function in another DLL, a dependency is created. Therefore, the program is no longer self-contained, and the program may experience problems if the dependency is broken.

异常情况

A dependent DLL is fixed.

A dependent DLL is upgraded to a new version.

A dependent DLL is removed from the computer.

A dependent DLL is overwritten with an earlier version.

动态链接库优点

Spring and Autumn Three Passage

模块化

Modularization

A DLL helps promote developing modular programs. This helps you develop large programs that require multiple language versions or a program that requires modular architecture. Besides, DLL can reduce the duplication of code that is loaded on the disk and in physical memory.

共享性

Shareability

Multiple programs can use the same DLL which helps code reuse. Besides, the multiple programs will all benefit from the update or the fix.

可维护

Maintainable

When a function within a DLL needs an update or a fix, the DLL does not require the program to be relinked with the DLL. (Also may caused DLL hell)

DLL地狱

Dynamic linked library hell

Incompatible versions

Dynamic linked library hell

A version of a library can be compatible with some programs that use it and incompatible with others.

Lack of serviceability

Dynamic linked library hell

Updates to a DLL do not affect all applications that use it becomes much harder to "service" the DLL

DLL stomping

Dynamic linked library hell

A newly installed program overwrites a working system DLL with an earlier, incompatible version.

Shared in-memory modules

Dynamic linked library hell

Aapplications reference the same in-memory copy, until no applications are using it and it is unloaded from memory.

Thank You!

Hell solution

Dynamic linked library hell

Static linking

Dynamic linked library hell

We can statically link all the libraries, i.e. to include the library version required in the program.

Windows File Protection

Dynamic linked library hell

This prevents unauthorized applications from overwriting system DLLs.

DLLs Simultaneously

Dynamic linked library hell

This works in general as long as the application is 32-bit or 64-bit, and that the DLL does not use shared memory.

Portable applications

Dynamic linked library hell

Every program bundles its own private copies of any DLLs it requires.

DLL分类

Types of Dynamic Linking

装载时动态链接

Load-time Dynamic Linking

在编译之前已经明确知道要调用DLL中的哪几个函数，编译时在目标文件中只保留必要的链接信息，而不含DLL函数的代码；当程序执行时，调用函数的时候利用链接信息加载DLL函数代码并在内存中将其链接入调用程序的执行空间中(全部函数加载进内存），其主要目的是便于代码共享。

运行时动态链接

Run-time Dynamic Linking

在编译之前并不知道将会调用哪些DLL函数，完全是在运行过程中根据需要决定应调用哪个函数，将其加载到内存中（只加载调用的函数进内存），并标识内存地址，其他程序也可以使用该程序，并用LoadLibrary和GetProcAddress动态获得DLL函数的入口地址。

DLL Advantages

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模块化

Modularization

模块化允许仅仅更改几个应用程序共享使用的一个DLL中的代码和数据而不需要更改应用程序自身。这种模块化的基本形式允许如Microsoft Windows的大的应用程序使用较为紧凑的补丁和服务包。

共享性

Shareability

多个程序可以共享同一段代码，而不需要在磁盘上存储多个拷贝，降低了容量的需求，也增加了修改的便捷性

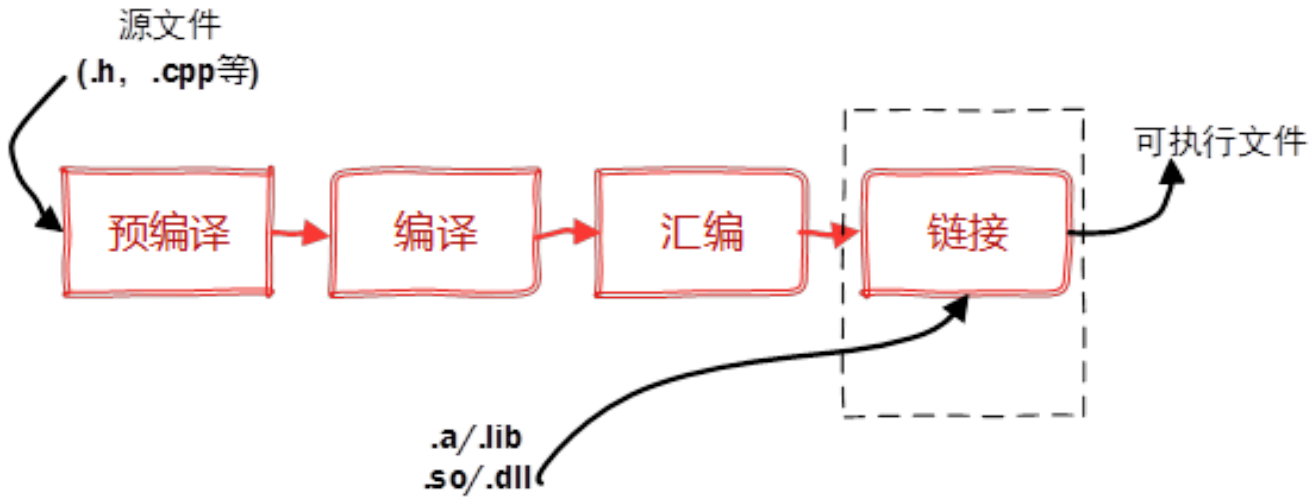
可维护/可扩展

Maintainable/Extendable

DLL文件与EXE文件独立，只要输出接口不变，更换DLL文件不会对EXE文件造成任何影响，提高了可维护性和可扩展性。

动态链接与静态链接

Background Introduction



简而言之

静态库、动态库的区别在于【链接阶段】如何处理库，链接成可执行程序。分别分为静态链接和动态链接

动态库与静态库

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静态库

Static Library

函数和数据被编译进一个二进制文件（扩展名通常为.lib）

编译链接可执行文件时，链接器从静态库中复制这些函数和数据，并把它们和应用程序的其他模块组合起来创建最终的可执行文件(.exe)

动态库

Dynamic Library

使用动态库时，往往提供两个文件：一个引入库(.lib,非必须)和一个.dll文件

引入库文件包含该动态库导出的函数和变量的符号名，而.dll文件包含该动态库实际的函数和数据。

背景介绍

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DLL way

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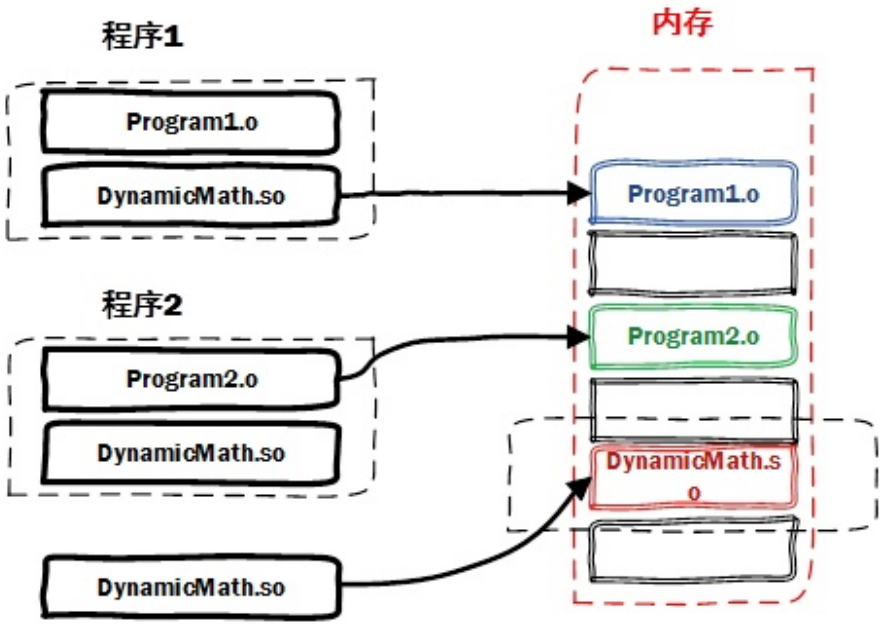

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