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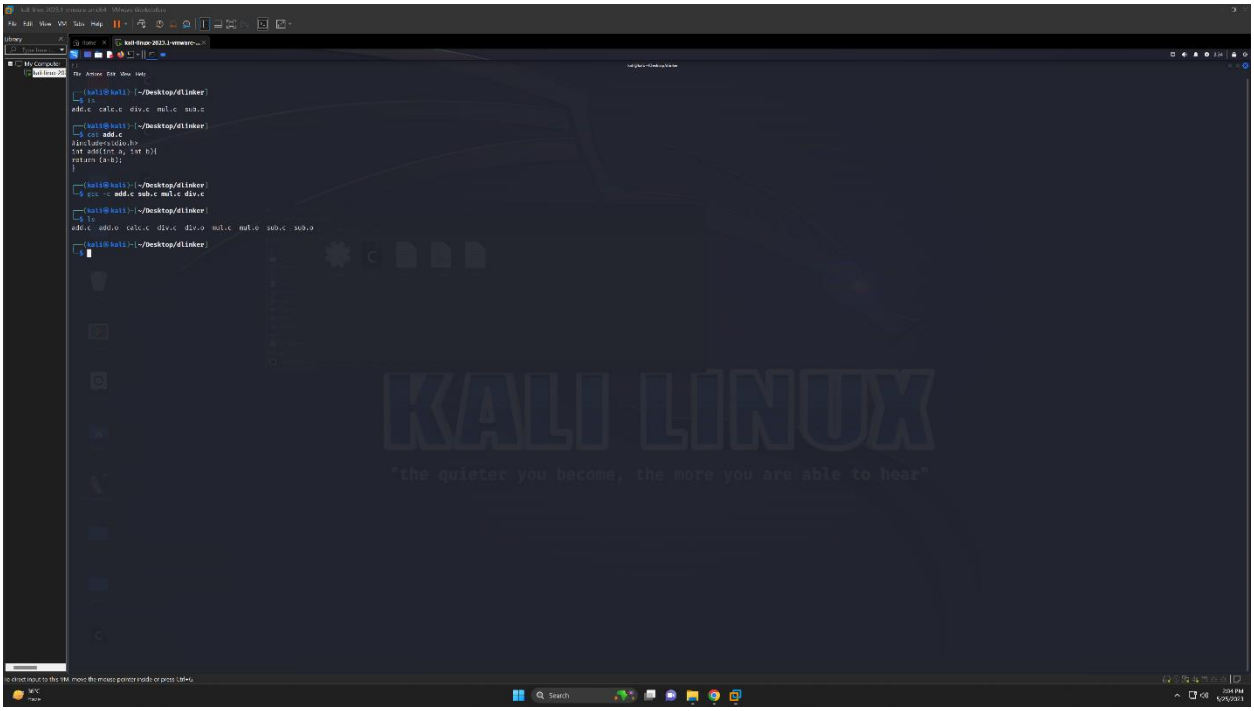
Subject: Software Supply Chain Security (CY 653)

Assignment 4: Generate a shared lib (dynamically linked lib) and integrate it to your software

1. **Study the online material, then repeat the exercise. Upload screenshots of your exercise. Use 'objdump -p <executable>' rather than 'ldd <executable>'.**

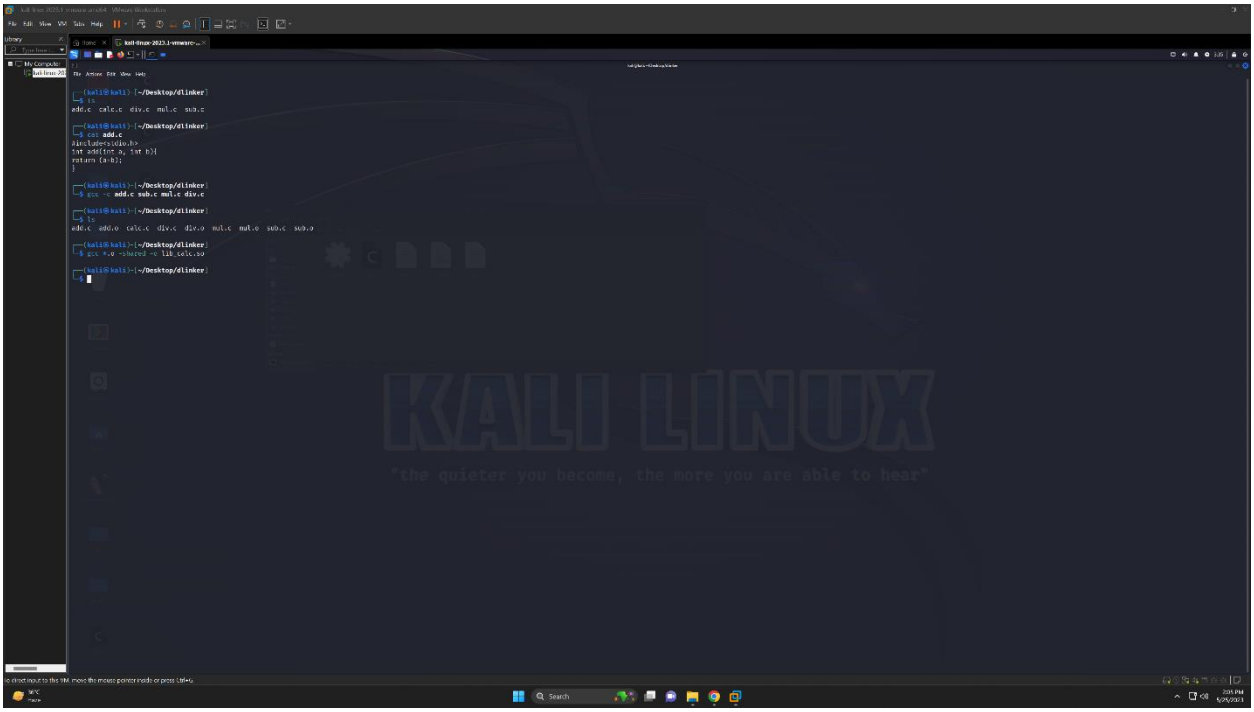
Detailed breakdown: Method 1: Copying the shared library

Step1: Created the c files for mathematical operations and also the main c file "calc." And also created the object files for the mathematical operator programs



The -c switch tells gcc to skip the linking step and create the object file

Step 2: After that I created a shared library named “lib_calc.so”



Breakdown of the command use:

The command is used for compiling a shared library, specifically **lib_calc.so**, from all object files (***.o**) in the current directory. Here's what each part of the command does:

- **gcc**: This is the GNU Compiler Collection. This command invokes the compiler. Although GCC supports several languages, it will interpret these files as C or C++ due to the **.o** extension.
- ***.o**: This is a wildcard that matches all files in the current directory that end in **.o**. These files are object files, which are compiled but not linked code.
- **-shared**: This is an option that tells GCC to produce a shared library rather than an executable. Shared libraries can be used by multiple programs at the same time.
- **-o lib_calc.so**: The **-o** option tells GCC where to put the output of the compilation. In this case, it will create a shared library called **lib_calc.so**.

Step 3: Created the object for the “calc.c” program using command “gcc -c calc.c -o calc.o”

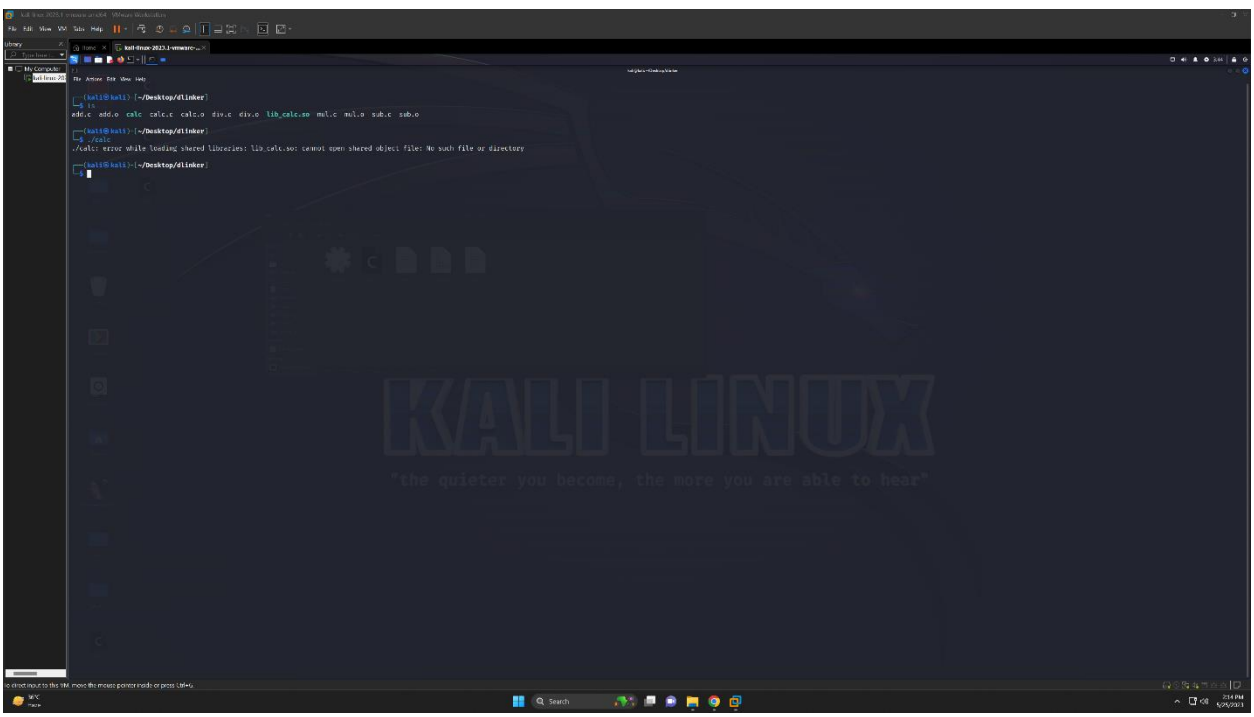
Step 4: For the getting the binary file for calc.c I used the command “gcc -o calc calc.o -L. -l_calc”

Break down of the command used

The command is used to compile and link an executable binary named **calc** using the object file **calc.o** and a shared library **lib_calc.so** located in the current directory:

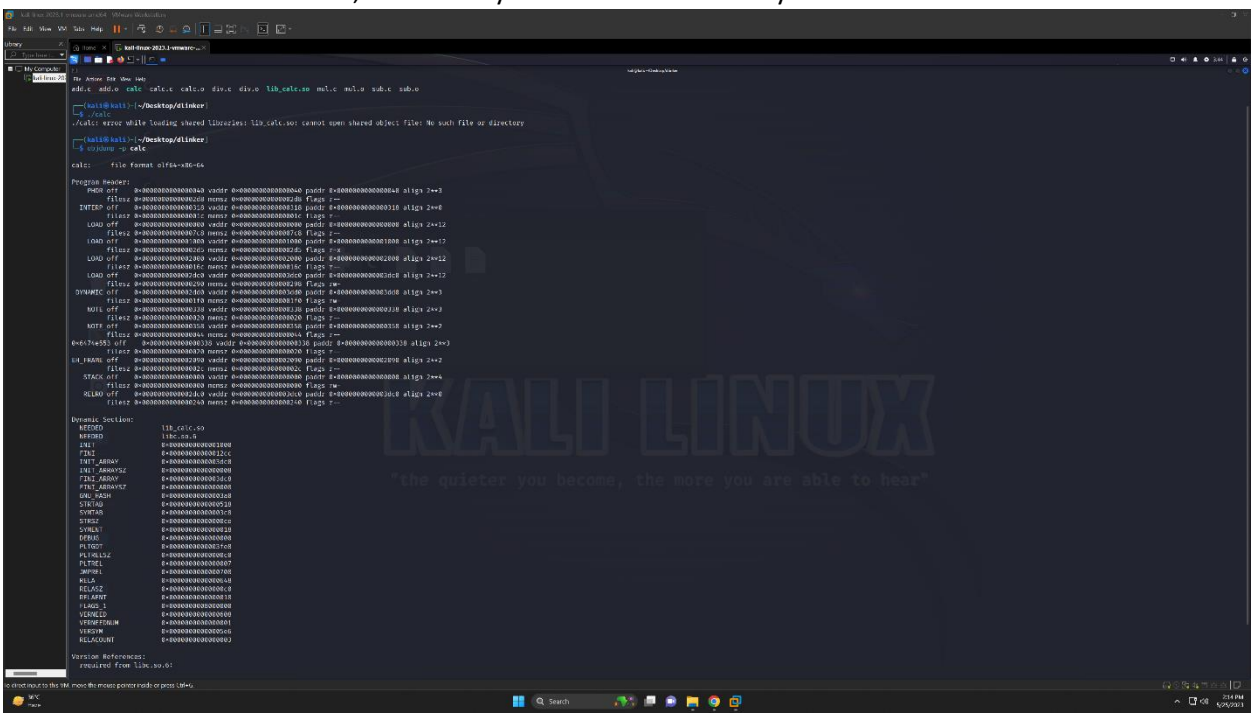
- **gcc**: The GNU Compiler Collection command invokes the compiler.
- **-o calc**: The **-o** option specifies the output file name. In this case, it is **calc**.
- **calc.o**: This is the input object file to be used in the creation of the executable.
- **-L.**: This flag tells the linker to look in the current directory for library files.
- **-l_calc**: The **-l** option tells the linker to link against a library. In this case, the library is **lib_calc.so**. The linker automatically prepends **lib** and appends **.so** (or **.a** for static libraries) when searching for the library file.

Tried to run the calc binary to see the error message:

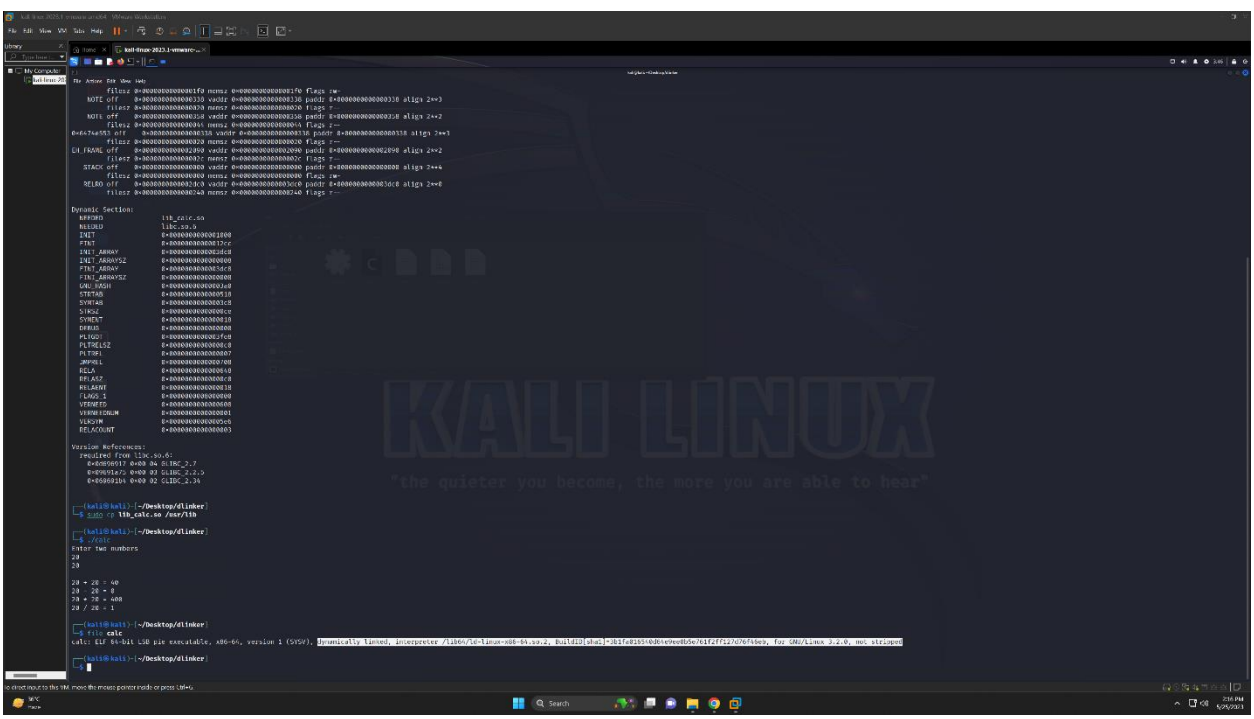


Step 5: Used command objdump -p calc to check which libraries the binary file is linked against.

When I ran **objdump -p calc**, it will display a lot of information about the binary. One of the sections is called "Dynamic Section", and it lists the shared libraries that the binary links to at runtime. The entries I looked for start with **NEEDED**, followed by the name of the library.



Copied the shared library lib_calc.so to /usr/lib and ran the binary file



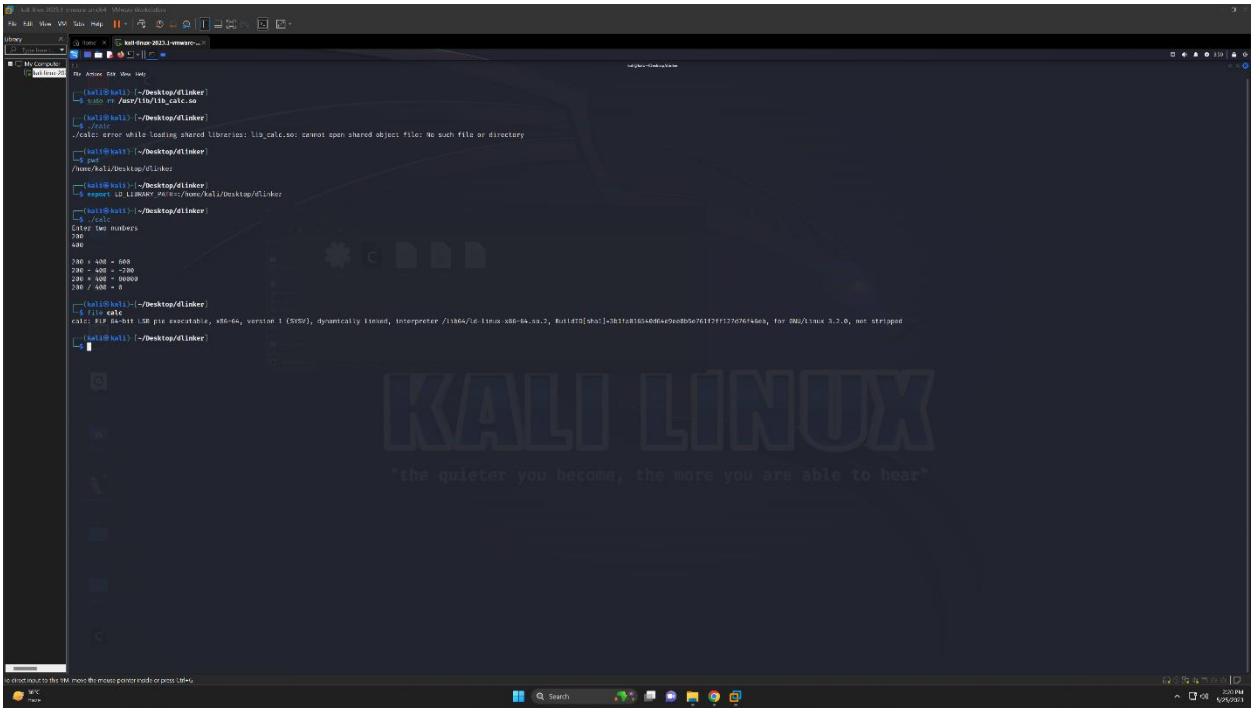
Method 2: Exporting the current working directory

Command used to use the current working directory “export LD_LIBRARY_PATH=:/home/kali/Desktop/dlinker”

Breakdown of the command used:

The **LD_LIBRARY_PATH** environment variable is used by the dynamic linker/loader (**ld.so** or **ld-linux.so**) in Unix-like systems to find necessary shared libraries. When I run a binary that needs a shared library (.so file), the system looks in several directories to find the library, including the ones listed in **LD_LIBRARY_PATH**.

This command appends the directory **/home/kali/Desktop/dlinker** to the existing **LD_LIBRARY_PATH**. Any colon-separated directories listed in **LD_LIBRARY_PATH** will be searched for shared libraries. This is done before the standard set of directories are searched by the linker.



Note: For this method changes made with export are only valid for the current shell session. For persistent change across all sessions we need to modify the “~/.bashrc”