Templates: CRTP

In this lesson, we will learn about curiously recurring template patterns in modern C++.

WE'LL COVER THE FOLLOWING ^ CRTP Typical use-case Mixins Static Polymorphism

CRTP

The acronym CRTP stands for the C++ idiom Curiously Recurring Template Pattern. CRTP is a technique in Modern C++ in which a Derived class derives from a class template Base. The key is that Base has Derived as a template argument.

Let's have a look at an example:

```
template<class T>
class Base{
    ...
};
class Derived: public Base<Derived>{
    ...
};
```

CRTP enables static polymorphism.

Typical use-case

There are two typical use-cases for CRTP: Mixins and static polymorphism.

Mixins

Mixinsis a popular concept in the design of classes used to mix in new code, meaning this technique it is commonly used in Python to change the behavior of a class by using multiple inheritances. In contrast to C++, in Python, it is possible to have more than one definition of a method in a class hierarchy. Python simply uses the method that is first in the Method Resolution Order (MRO).

You can implement mixins in C++ by using CRTP. A prominent example is the class std::enable_shared_from_this. By using this class, you can create objects that return an std::shared_ptr to themselves. We must derive your class MySharedClass public from std::enable_shared_from_this. Now, our class MySharedClass has a method, shared_from_this..

An additional typical use-case for mixins is for a class that you want to extend with the capability that their instances support the comparison for equality and inequality.

Static Polymorphism

Static polymorphism is similar to dynamic polymorphism. Contrary to dynamic polymorphism with virtual methods, the dispatch of the method calls will take place at compile-time.

```
class ShareMe: public std::enable_shared_from_this<ShareMe>{
   std::shared_ptr<ShareMe> getShared(){
     return shared_from_this();
   }
};
```

- std::enable_shared_from_this creates a shared _ptr for an object.
- std::enable_shared_from_this: base class of the object.
- shared_from_this: returns the shared object

To learn more about CRTP, read here.

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