CRTP

Let's learn about CRTP in this lesson.

WE'LL COVER THE FOLLOWING

CRTP

The acronym CRTP stands for the C++ idiom **C**uriously **R**ecurring **T**emplate **P**attern. It is a technique in 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

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Mixins

Mixins are a popular concept in the design of classes used to mix in new code. Therefore, it's a technique often used in Python to change the behavior of a class by using multiple inheritances. In contrast to C++, it is legal in Python to have more than one definition of a method in a class hierarchy. Python simply uses the first method in the Method Resolution Order (MRO).

We can implement mixins in C++ by using CRTP. A prominent example is the class `std::enable_shared_from_this`. Using this class, we can create objects that return an `std::shared_ptr` with themselves. We have to derive the public class `MySharedClass` from `std::enable_shared_from_this`. Now, our `MySharedClass` has a method called `shared_from_this`.

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

Static polymorphism

Static polymorphism is quite similar to dynamic polymorphism. But contrary to dynamic polymorphism with virtual methods, the dispatch of the method calls will take place at compile-time. Now, we are at the center of the CRTP idiom.

```
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:` is the base class of the object.
- `shared_from_this:` returns the shared object.

Further information

- CRTP
- Mixins

- Method Resolution Order

In the next lesson, we'll look at a couple of examples of CRTP.