Introduction to std::shared_future

This lesson gives an introduction to std::shared_future which is used in C++ for multithreading.

WE'LL COVER THE FOLLOWING

- std::shared_future

std::shared_future

A future becomes shared by using `fut.share()`. A shared future is associated with its promise and can independently ask for the result. An `std::shared` future has the same interface as an `std::future`.

In addition to the `std::future`, a `std::shared_future` enables us to query the promise independently of the other associated futures.

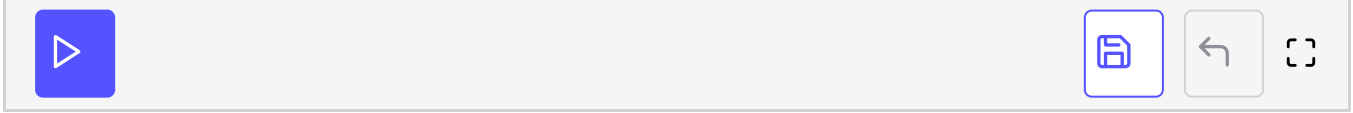
There are two ways to create a `std::shared_future`:

1. Invoke `fut.share()` on an `std::future fut`. Afterwards, the result is no longer available. That means `valid == false`.
2. Initialize an `std::shared_future` from an `std::promise`: `std::shared_future<int> divResult= divPromise.get_future()`.

The handling of an `std::shared_future` is special.

```
// sharedFuture.cpp

#include <future>
#include <iostream>
#include <thread>
#include <utility>

std::mutex coutMutex;

struct Div{

  void operator()(std::promise<int>&& intPromise, int a, int b){
    intPromise.set_value(a/b);
```

```
  }

};


struct Requestor{

  void operator ()(std::shared_future<int> shaFut){

    // lock std::cout
    std::lock_guard<std::mutex> coutGuard(coutMutex);

    // get the thread id
    std::cout << "threadId(" << std::this_thread::get_id() << "): " ;

    std::cout << "20/10= " << shaFut.get() << std::endl;

  }

};

int main(){

  std::cout << std::endl;

  // define the promises
  std::promise<int> divPromise;

  // get the futures
  std::shared_future<int> divResult = divPromise.get_future();

  // calculate the result in a separat thread
  Div div;
  std::thread divThread(div, std::move(divPromise), 20, 10);

  Requestor req;
  std::thread sharedThread1(req, divResult);
  std::thread sharedThread2(req, divResult);
  std::thread sharedThread3(req, divResult);
  std::thread sharedThread4(req, divResult);
  std::thread sharedThread5(req, divResult);

  divThread.join();

  sharedThread1.join();
  sharedThread2.join();
  sharedThread3.join();
  sharedThread4.join();
  sharedThread5.join();

  std::cout << std::endl;

}
```



Both work packages, that of the promise and that of the future, are function objects in this current example. In line 46, `divPromise` will be moved and

executed in the thread `divThread`. Accordingly, `std::shared_future`s are copied in all five threads (lines 57 - 61). It's important to emphasize it once more: In contrast to an `std::future` object that can only be moved, we can copy an `std::shared_future` object.

The main thread waits in lines 57 to 61 for its child threads to finish their jobs and to display their results.

> Dividing a number by 0 shows undefined behavior.

This concludes our discussion of tasks.