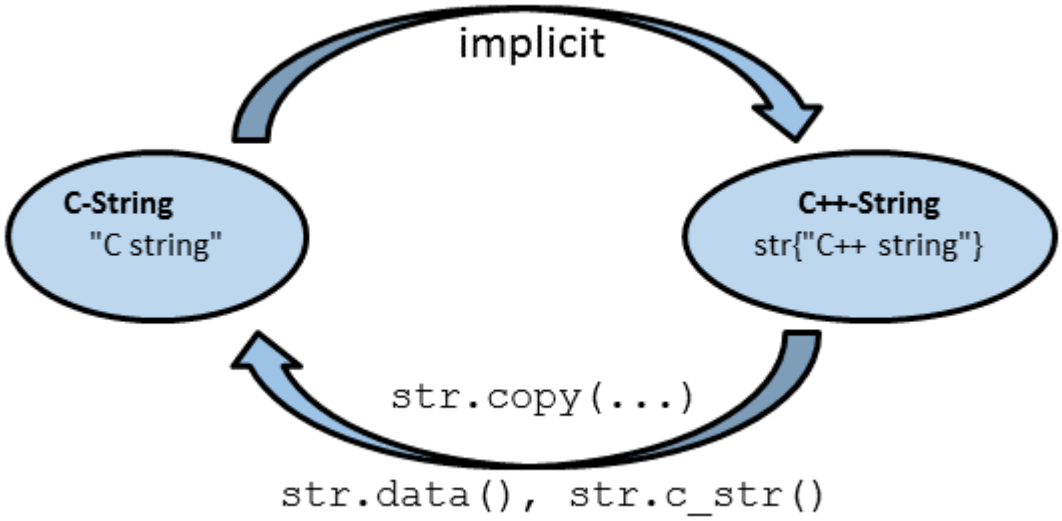
Numeric Conversions

Apart from conversions to C string, a string can also be converted to a float.



We can convert numbers or floating point numbers to the corresponding `std::string` or `std::wstring` with `std::to_string(val)` and `std::to_wstring(val)`.

The inverse of the aforementioned (for the numbers or floating point numbers) can be achieved through a function family of `sto`* functions. All functions need the header `<string>`.

> 🔑 **Read sto * as 'string to'**
> The seven ways to convert a string into a natural or floating point number follow a simple pattern. All functions start with `sto` and add further characters, denoting the type to which the strings should be converted. For example, `stol` stands for 'string to `long`' or `stod` for 'string to `double`'.

The `sto` functions all have the same interface. The example shows it for the type `long`.

```
std::stol(str, idx= nullptr, base= 10)
```

The function takes a string and determines the `long` representation of the base `base`. `stol` ignores leading spaces and optionally returns the index of the first invalid character in `idx`. By default, the base is 10. Valid values for the base are 0 and 2 through 36. If we use base 0, the compiler automatically determines the type based on the format of the string. If the base is bigger than 10, the compiler encodes them in the characters `a` to `z`. The representation is analogous to the representation of hexadecimal numbers.

The table gives an overview of all functions.

Method	Description
`std::to_string(val)`	Converts `val` into a `std::string`.
`std::to_wstring(val)`	Converts `val` into a `std::wstring`.
`std::stoi(str)`	Returns an `int` value.
`std::stol(str)`	Returns a `long` value.
`std::stoll(str)`	Returns a `long long` value.
`std::stoul(str)`	Returns an `unsigned long` value.
`std::stoull(str)`	Returns an `unsigned long long` value.
`std::stof(str)`	Returns a `float` value.
`std::stod(str)`	Returns a `double` value.
`std::stold(str)`	Returns an `long double` value.

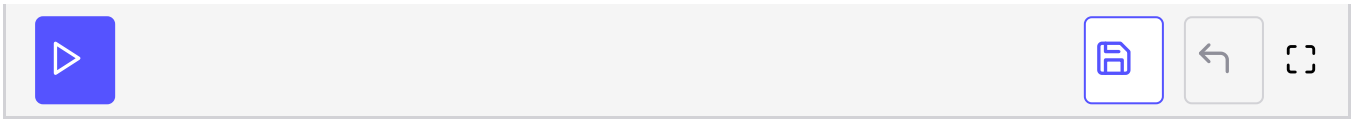
Numeric conversion of strings

> **ℹ Where is the stou function?**
> In case we're curious, the C++ `sto` functions are thin wrappers around the C `strto*` functions, but there is no `strtou` function in C. Therefore C++ has no `stou` function.

The functions throw an `std::invalid_argument` exception if the conversion is not possible. If the determined value is too big for the destination type, we get an `std::out_of_range` exception.

```
#include <iostream>
#include <limits>
#include <string>

int main(){

  //std::cout << std::endl;

  std::cout << "to_string, to_wstring" << std::endl;

  std::string maxLongLongString=std::to_string(std::numeric_limits<long long>::max());
  std::wstring maxLongLongWstring=std::to_wstring(std::numeric_limits<long long>::max());

  std::cout << std::numeric_limits<long long>::max() << std::endl;
  std::cout << maxLongLongString << std::endl;
  std::wcout <<  maxLongLongWstring <<  std::endl;

  std::cout << std::endl;

  std::cout << "ato* " << std::endl;

  std::string str("10010101");

  std::cout << std::stoi(str) << std::endl;
  std::cout << std::stoi(str, nullptr, 16) << std::endl;
  std::cout << std::stoi(str, nullptr, 8) << std::endl;
  std::cout << std::stoi(str, nullptr, 2) << std::endl;

  std::cout << std::endl;

  std::size_t idx;
  std::cout << std::stod("   3.5 km", &idx) << std::endl;
  std::cout << "Not numeric char at position " << idx << "." << std::endl;

  std::cout << std::endl;

  try{
    std::cout << std::stoi("   3.5 km") << std::endl;
    std::cout << std::stoi("   3.5 km", nullptr, 2) << std::endl;

  }
  catch (const std::exception& e){
```

```
    std::cerr <<  e.what() << std::endl;
  }

  std::cout << std::endl;

}
```



Numeric conversion (Expected Error)

This concludes our discussion of strings and the key features available for them. In the next chapter, we'll talk about regular expressions in detail.