

STL

STL introduction



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Agenda

- ① What is STL?
- ② Components of STL
- ③ Containers
- ④ Iterators
- ⑤ Algorithms
- ⑥ Functors

What is STL?

Standard Template Library (STL) is a software library for the C++ programming language that influenced many parts of the C++ standard library.

Three components

STL provides 3 components :

- ① Containers
- ② Iterators
- ③ Algorithms

The STL provides a set of common classes for C++, such as containers and associative arrays, that can be used with any built-in type and with any user defined type that supports some elementary operations.

STL algorithms are independent of containers, which significantly reduces the complexity of the library.

The STL achieves its result through the use of templates.

Containers

The STL provides various type-safe containers for storing collections of related objects.

The containers are class templates

Type-safe means compiler will check that you don't mix (incompatible) data types

Containers

When you declare a container variable, you specify the type of the elements that the container will hold.

Containers can be constructed with initializer lists. They have member functions for adding and removing elements and doing other operations

You iterate over the elements in a container, and access the individual elements by using iterators.

You can use iterators explicitly by using their member functions and operators and global functions.

You can also use them implicitly, for example by using a range-for loop.

Types of Containers

- Sequence Containers
- Associative Containers
- Container Adapters

Sequence Containers

vector, array, deque, list, forward_list.

Sequence containers maintain the ordering of inserted elements that you specify.

vector - dynamic arrays

array - not resizable

deque - double ended queue

list - doubly linked list

forward-list - Singly linked list

Associative Containers

map, set, multimap, multiset

In associative containers, elements are inserted in a predefined order - for example, as sorted ascending.

Unordered associative containers are also available. unordered_set, unordered_map, unordered_multiset, unordered_multimap.

set BST

map RBT

multiset BST

multimap RBT

unordered_set Hash Table
unordered_map Hash Table
unordered_multiset Hash Table
unordered_multimap Hash Table

A map is sometimes referred to as dictionary, consists of key-value pair. The key is used to order the sequence and the value associated with that key.

A set is just an ascending container of unique elements. The value is also the key.

In multimap and multiset, duplicate keys are allowed.

Ordered map and sets supports bidirectional iterators.

Container Adapters

stack, queue, priority_queue

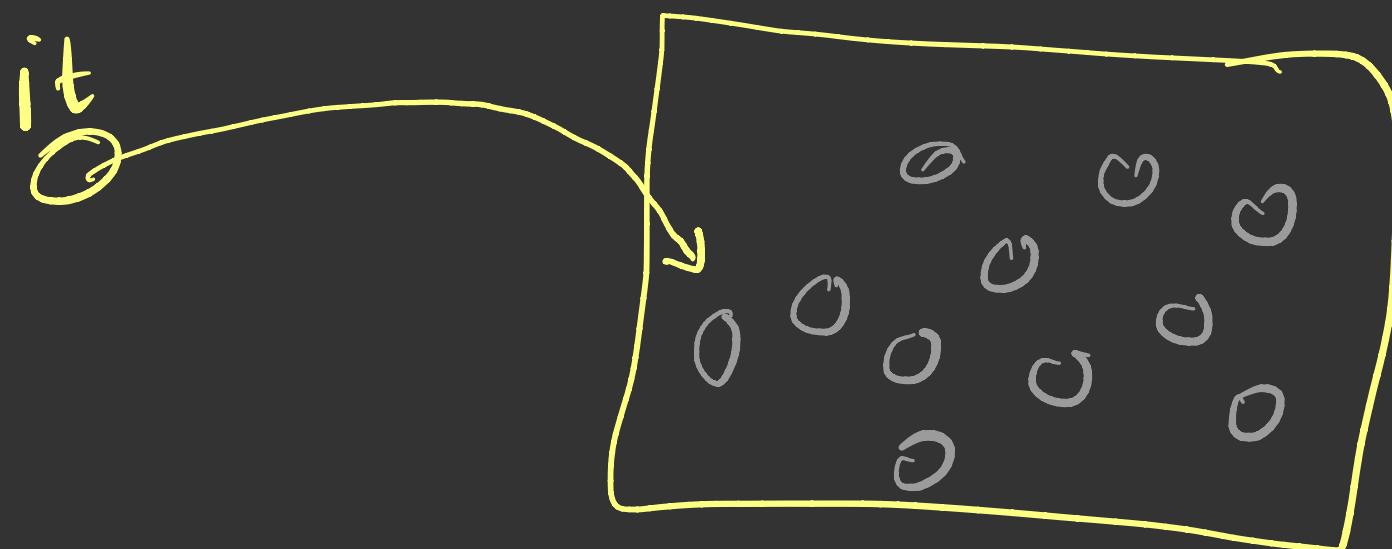
Container adapter is a variation of a sequence container that restricts the interface for simplicity and clarity.

Container Adapters do not support iterators

Container Adapters cannot be used with STL algorithms.

Iterators

An iterator is an object that can iterate over elements in a container and provide access to individual elements.



Types of Iterators

input iterators

only reading

Output iterators

only writing

forward iterators

read & write, move forward
only

bidirectional

read & write, move forward
& backward

random access iterator

read & write, move freely
any number of steps

Algorithms

Algorithms are a fundamental part of
the C++ Standard library

Algorithms do not work with containers
themselves but rather with iterators.

Functors

Also known as function objects.

Functors is any type that implements operator ()

() is called the call operator.

STL uses function objects primarily as sorting criteria for containers and in algorithms.

Advantages of Functions

- ① It is an object, therefore it may contain state.
- ② It is a type therefore can be used as a template parameter.

Example

```
class Functor
{
public:
    int operator() (int a, int b)
    {
        return a < b;
    }
}
```

```
};

int main()
{
    Functor f;
    int a = f(5, 7);
```

It looks like a function call
but it is an object calling
the call operator.