

Filter Iterator

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abstract: The filter iterator adaptor creates a view of an iterator range in which some elements of the range are skipped. A predicate function object controls which elements are skipped. When the predicate is applied to an element, if it returns `true` then the element is retained and if it returns `false` then the element is skipped over. When skipping over elements, it is necessary for the filter adaptor to know when to stop so as to avoid going past the end of the underlying range. A filter iterator is therefore constructed with pair of iterators indicating the range of elements in the unfiltered sequence to be traversed.

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filter_iterator synopsis

```
template <class Predicate, class Iterator>
class filter_iterator
{
public:
    typedef iterator_traits<Iterator>::value_type value_type;
    typedef iterator_traits<Iterator>::reference reference;
    typedef iterator_traits<Iterator>::pointer pointer;
    typedef iterator_traits<Iterator>::difference_type difference_type;
    typedef /* see below */ iterator_category;

    filter_iterator();
    filter_iterator(Predicate f, Iterator x, Iterator end = Iterator());
    filter_iterator(Iterator x, Iterator end = Iterator());
    template<class OtherIterator>
    filter_iterator(
        filter_iterator<Predicate, OtherIterator> const& t
        , typename enable_if_convertible<OtherIterator, Iterator>::type* = 0 // exposition
    );
    Predicate predicate() const;
    Iterator end() const;
    Iterator const& base() const;
    reference operator*() const;
```

```

    filter_iterator& operator++();
private:
    Predicate m_pred; // exposition only
    Iterator m_iter;  // exposition only
    Iterator m_end;   // exposition only
};

```

If `Iterator` models `Readable Lvalue Iterator` and `Forward Traversal Iterator` then `iterator_category` is convertible to `std::forward_iterator_tag`. Otherwise `iterator_category` is convertible to `std::input_iterator_tag`.

filter_iterator requirements

The `Iterator` argument shall meet the requirements of `Readable Iterator` and `Single Pass Iterator` or it shall meet the requirements of `Input Iterator`.

The `Predicate` argument must be `Assignable`, `Copy Constructible`, and the expression `p(x)` must be valid where `p` is an object of type `Predicate`, `x` is an object of type `iterator_traits<Iterator>::value_type`, and where the type of `p(x)` must be convertible to `bool`.

filter_iterator models

The concepts that `filter_iterator` models are dependent on which concepts the `Iterator` argument models, as specified in the following tables.

If <code>Iterator</code> models	then <code>filter_iterator</code> models
Single Pass Iterator	Single Pass Iterator
Forward Traversal Iterator	Forward Traversal Iterator

If <code>Iterator</code> models	then <code>filter_iterator</code> models
Readable Iterator	Readable Iterator
Writable Iterator	Writable Iterator
Lvalue Iterator	Lvalue Iterator

If <code>Iterator</code> models	then <code>filter_iterator</code> models
Readable Iterator, Single Pass Iterator	Input Iterator
Readable Lvalue Iterator, Forward Traversal Iterator	Forward Iterator
Writable Lvalue Iterator, Forward Traversal Iterator	Mutable Forward Iterator

`filter_iterator<P1, X>` is interoperable with `filter_iterator<P2, Y>` if and only if `X` is interoperable with `Y`.

filter_iterator operations

In addition to those operations required by the concepts that `filter_iterator` models, `filter_iterator` provides the following operations.

```
filter_iterator();
```

Requires: `Predicate` and `Iterator` must be `Default Constructible`.

Effects: Constructs a `filter_iterator` whose “`m_pred`”, “`m_iter`”, and “`m_end`” members are a default constructed.

```
filter_iterator(Predicate f, Iterator x, Iterator end = Iterator());
```

Effects: Constructs a `filter_iterator` where “`m_iter`” is either the first position in the range `[x,end)` such that `f(*m_iter) == true` or else “`m_iter == end`”. The member “`m_pred`” is constructed from `f` and “`m_end`” from `end`.

```
filter_iterator(Iterator x, Iterator end = Iterator());
```

Requires: Predicate must be Default Constructible and Predicate is a class type (not a function pointer).

Effects: Constructs a filter_iterator where m_iter is either the first position in the range [x,end) such that m_pred(*m_iter) == true or else "m_iter == end". The member m_pred is default constructed.

```
template <class OtherIterator>
filter_iterator(
    filter_iterator<Predicate, OtherIterator> const& t
    , typename enable_if_convertible<OtherIterator, Iterator>::type* = 0 // exposition
);‘‘
```

Requires: OtherIterator is implicitly convertible to Iterator.

Effects: Constructs a filter iterator whose members are copied from t.

```
Predicate predicate() const;
```

Returns: m_pred

```
Iterator end() const;
```

Returns: m_end

```
Iterator const& base() const;
```

Returns: m_iterator

```
reference operator*() const;
```

Returns: *m_iter

```
filter_iterator& operator++();
```

Effects: Increments m_iter and then continues to increment m_iter until either m_iter == m_end or m_pred(*m_iter) == true.

Returns: *this

```
template <class Predicate, class Iterator>
filter_iterator<Predicate,Iterator>
make_filter_iterator(Predicate f, Iterator x, Iterator end = Iterator());
```

Returns: filter_iterator<Predicate,Iterator>(f, x, end)

```
template <class Predicate, class Iterator>
filter_iterator<Predicate,Iterator>
make_filter_iterator(Iterator x, Iterator end = Iterator());
```

Returns: filter_iterator<Predicate,Iterator>(x, end)

Example

This example uses filter_iterator and then make_filter_iterator to output only the positive integers from an array of integers. Then make_filter_iterator is is used to output the integers greater than -2.

```
struct is_positive_number {
    bool operator()(int x) { return 0 < x; }
};

int main()
{
    int numbers_[] = { 0, -1, 4, -3, 5, 8, -2 };
    const int N = sizeof(numbers_)/sizeof(int);

    typedef int* base_iterator;
```

```

base_iterator numbers(numbers_);

// Example using filter_iterator
typedef boost::filter_iterator<is_positive_number, base_iterator>
    FilterIter;

is_positive_number predicate;
FilterIter filter_iter_first(predicate, numbers, numbers + N);
FilterIter filter_iter_last(predicate, numbers + N, numbers + N);

std::copy(filter_iter_first, filter_iter_last, std::ostream_iterator<int>(std::cout, " "));
std::cout << std::endl;

// Example using make_filter_iterator()
std::copy(boost::make_filter_iterator<is_positive_number>(numbers, numbers + N),
          boost::make_filter_iterator<is_positive_number>(numbers + N, numbers + N),
          std::ostream_iterator<int>(std::cout, " "));
std::cout << std::endl;

// Another example using make_filter_iterator()
std::copy(
    boost::make_filter_iterator(
        std::bind2nd(std::greater<int>()), -2)
        , numbers, numbers + N)

    , boost::make_filter_iterator(
        std::bind2nd(std::greater<int>()), -2)
        , numbers + N, numbers + N)

    , std::ostream_iterator<int>(std::cout, " ")
);

std::cout << std::endl;

return boost::exit_success;
}

```

The output is:

```

4 5 8
4 5 8
0 -1 4 5 8

```

The source code for this example can be found [here](#).