# STL Random-Access Iterators

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- *Random-access* iterators allow algorithms random-access to elements stored in a container that provides *random-access* iterators
  - *e.g.,* **`vector`** *&* **`deque`**

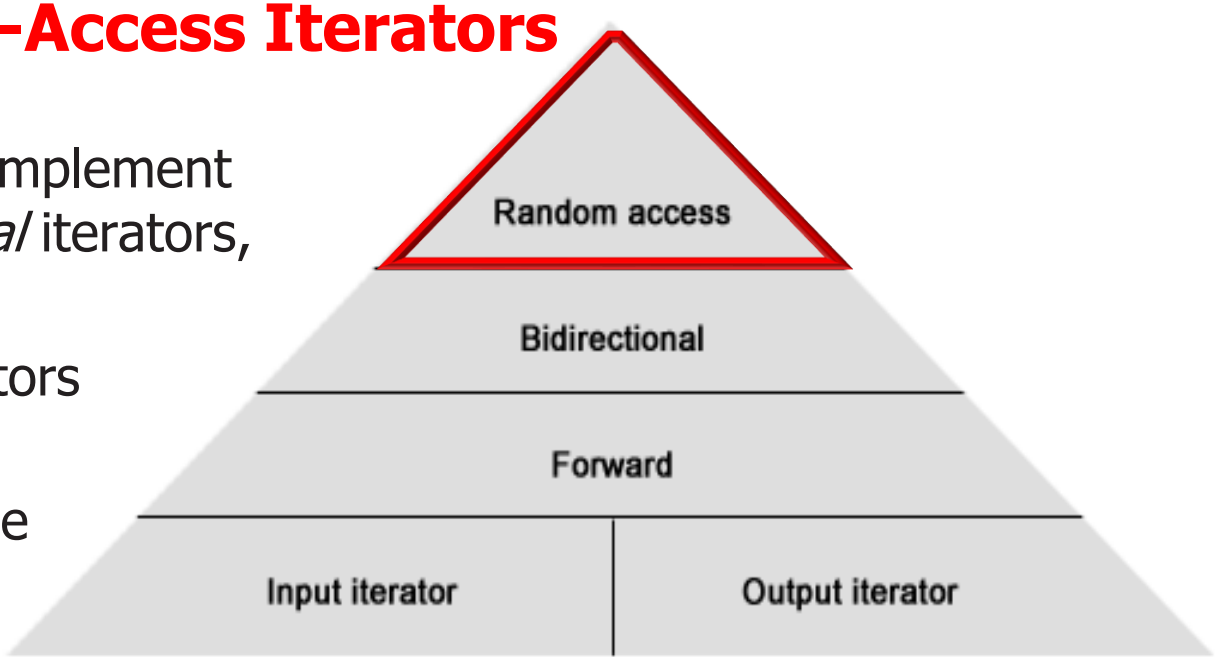
```
vector<string> v {"a", "b", "c", "d",
                  ... "j"};

auto p = v2.begin();
p += 5
p[1] = "z";
p -= 5;
```

See www.cplusplus.com/reference/iterator/RandomAccessIterator/

# STL Random-Access Iterators

- *Random-access* iterators must implement the requirements for *bidirectional* iterators, plus:
  - Arithmetic assignment operators += & −=
  - Operators + & − (must handle symmetry of arguments)
  - Relational operators < & > & <= & >=
  - Subscript operator [ ]



# STL Random-Access Iterator Example

```
int main() {
  vector<int> v {1, 2, 3, 4};
  auto i = v.begin();
  auto j = i + 2; cout << *j << " ";

  i += 3; cout << *i << " ";
  j = i - 1; cout << *j << " ";
  j -= 2;
  cout << *j << " " << v[1] << endl;

  j < i ? cout << "j < i" : cout << "not (j < i)"; cout << endl;
  j > i ? cout << "j > i" : cout << "not (j > i)"; cout << endl;

  i = j;
  i <= j && j <= i ? cout << "i and j equal" : cout << "i and j not equal";
  cout << endl;
}
```

See github.com/douglascraigschmidt/CPlusPlus/tree/master/STL/S-04/4.7

# Implementing Iterators Using STL Patterns

- A C++ iterator provides a familiar & standard interface, so you may want to add one to your own classes so you can "plug-and-play" with STL algorithms

```
template <typename T>
class ArrayListIterator : public
  std::iterator<std::
    random_access_iterator_tag, T> {
public:
  T &operator*();
  const T &operator*() const;
  T *operator->();
  const T *operator->() const;
  ArrayListIterator<T> &operator++();
  ArrayListIterator<T> &operator--();
  ...
private:
  explicit ArrayListIterator(T *ptr);
  T *mPtr;
};
```

See users.cs.northwestern.edu/~riesbeck/programming/c++/stl-iterator-define.html

# Implementing Iterators Using STL Patterns

- Writing your own iterators is a straight-forward (albeit *tedious)* process, with only a few subtleties you should be aware of
  - *e.g.*, which category to support, pre- & post-increment/decrement operators, etc.

```
template <typename T>
class ArrayListIterator : public
  std::iterator<std::
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public:
  T &operator*();
  const T &operator*() const;
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private:
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