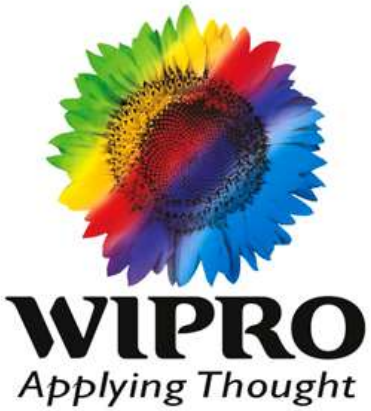


List

Agenda

1. List
2. ArrayList
3. Vector
4. LinkedList

Understanding List

List

- List interface extends from Collection interface
- It stores elements in a **sequential manner**
- Elements in the list can be accessed or inserted based on their position
- Starts with **zero based index**
- Can contain duplicate elements
- An Iterator can be used to access the elements of the List

- **Please refer documentation and note down the important methods available in List interface**

The ArrayList Class

- ArrayList class implements List interface
- It supports **dynamic array** that can grow dynamically
- Standard arrays are of fixed size. After arrays are created they cannot grow or shrink
- It provides more powerful insertion and search mechanisms than arrays
- Gives faster Iteration and fast random access
- **Ordered Collection** (by index), but not **Sorted**

```
ArrayList<Integer> list = new
  ArrayList<Integer>();
list.add(0, new Integer(42));
int total = list.get(0).intValue();
```

Refer documentation for the various ways in which an ArrayList can be created and the various methods available in ArrayList

Example

Let's Check the power of ArrayList with an example:

```
import java.util.*;
public class ArrayListTest {
public static void main(String[] args) {
List<String> test = new ArrayList<String>();
String s = "hi";
test.add("string");
test.add(s);
test.add(s+s);
System.out.print(test.size());
System.out.print(test.contains(42));
System.out.print(test.contains("hihi"));
test.remove("hi");
System.out.print(test.size());
} }
```

which produces:

3 false true 2

Iterator

- Iterator is an object that enables you to **traverse through a collection**
- Can be used to remove elements from the collection selectively, if desired

```
public interface Iterator<E>

 {
 boolean hasNext();
 E next();
 void remove();
 }
```

```
ArrayList<Integer> ai=new ArrayList<Integer>();
Iterator i=ai.iterator();
while (i.hasNext())
System.out.println(i.next());
```

Iterator

- Java provides 2 interfaces that define the methods by which you can access each element of a collection : enumeration & iterators. Enumeration is a legacy interface and is considered obsolete for new code. It is now superceded by the iterator interface.
- The iterator() method returns an iterator to a collection. It is very similar to an Enumeration, but differs in the two respects:
- Iterator allows the caller to remove elements from the underlying collection during the iteration with well-defined semantics.
- Method names have been improved.
- The first point is important: There was *no* safe way to remove elements from a collection while traversing it with an Enumeration. The semantics of this operation were ill defined, and differed from implementation to implementation.
- **boolean hasNext() -** Returns true if there are more elementsObject
- **next() -** Returns next element. Throws NoSuchElementException if there is no next element.
- **void remove() -** Removes current element. Throws IllegalStateException if an attempt is made to call remove() that is not preceded by a call to next()

ListIterator

- Used for obtaining a iterator for collections that implement List
- ListIterator gives us the ability to access the collection in either **forward or backward direction**
- Has both next() and previous() method to access the next and previous element in the List

Example

```
class ListIteratorExample {
   public static void main(String[] args) {
     ArrayList aList = new ArrayList();
     //Add elements to ArrayList object
    aList.add("1");
    aList.add("2");
    aList.add("3");
   ListIterator listIterator = aList.listIterator();
     System.out.println("Previous Index is : " + listIterator.previousIndex());
    System.out.println("Next Index is : " + listIterator.nextIndex());
       //advance current position by one using next method
    listIterator.next();
       System.out.println("After increasing current position by one element : ");
    System.out.println("Previous Index is : " + listIterator.previousIndex());
    System.out.println("Next Index is : " + listIterator.nextIndex());
    }}
```

Advantage of Iterator over for-each method

- for-each construct can also be used for iterating through the Collection
- Use Iterator instead of the for-each construct when you need to:
  - Remove the current element
    - The for-each construct hides the iterator, so you cannot call remove
  - Iterate over multiple collections in parallel

```
for(Object o : oa) {
Fruit d2 = (Fruit)o;
System.out.println(d2.name); }
```

Enhanced for loop

- Iterating over collections looks cluttered

```
void printAll(Collection<emp> e) {
 for (Iterator<emp> i = e.iterator();
  i.hasNext(); )
 System.out.println(i.next()); } }
```

- Using enhanced for loop we can do the same thing as

```
void printAll(Collection<emp> e) {
 for (emp t: e) )
 System.out.println(t); }}
```

- The loop above reads as “for each emp t in e.”

Linked List

- Implements the List and also the Queue interface
- Some Useful Methods
  - void addFirst(Object x)
  - void addLast(Object x)
  - Object getFirst()
  - Object getLast()
  - Object removeFirst()
  - Object removeLast()

The Vector Class

- The java.util.Vector class implements a **growable array of Objects**
- Same as ArrayList, but Vector methods are **synchronized** for thread safety
- New java.util.Vector is implemented from List Interface
- Creation of a Vector

  - `Vector v1 = new Vector(); // allows old or new methods`
  - `List v2 = new Vector(); // allows only the new (List) methods.`

Points to Ponder

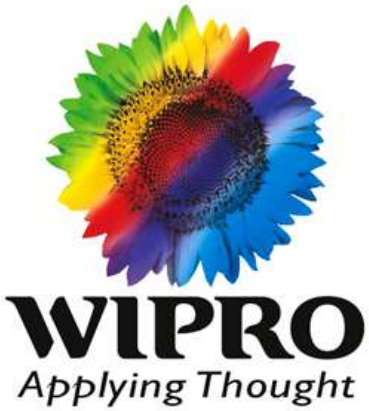
- Use List Collection classes if the order in which the element added matters
- Use List when you want to perform insert, delete and update operations based on particular positions in the list
- ArrayList, LinkedList and Vector all of them implement List interface
- LinkedList provides a better performance over ArrayList in insertion and deletion operation.
- In case of frequent insertion and deletion operation the choice can be LinkedList than ArrayList
- Search operations are faster in ArrayList
- Both ArrayList and LinkedList are not synchronized
- Vector is synchronized
- If thread safety is not important, then we should choose either ArrayList or LinkedList

Quiz

1. Which of the following class is synchronized?
   a. ArrayList
   b. Vector
   c. LinkedList
   d. All of the above
2. In which of the following classes position based operations can be performed?
   a. ArrayList
   b. LinkedList
   c. Vector
   d. All of the above

Summary

- In this module, you have learnt
  - How to work with
    - ArrayList
    - LinkedList
    - Vector



Thank You