



# Generics

# Agenda

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## Generics

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# What are and Why Generics?

**Mechanism by which a single piece of code can manipulate many different data types without explicitly having a separate entity for each data type**

- **Before Generics**

```
List myIntegerList = new LinkedList(); // 1
myIntegerList.add(new Integer(0)); // 2
Integer x = (Integer) myIntegerList.iterator().next(); // 3
```

*Line no 3 if not properly typecasted will throw runtime exception*

- **After Generics**

```
List<Integer> myIntegerList = new LinkedList<Integer>(); // 1
myIntegerList.add(new Integer(0)); //2
Integer x = myIntegerList.iterator().next(); // 3
```

*No need for typecasting here*

# What problems does Generics solve?

- **Problem: Collection element types**

- Compiler is unable to verify types
- Assignment must have type casting
- *ClassCastException* can occur during runtime

- **Solution: Generics**

- Tell the compiler type of the collection
- Let the compiler fill in the cast
- Example: Compiler will check if you are adding Integer type entry to a String type collection (compile time detection of type mismatch)

## Using Generic class

- **Instantiate a generic class to create type specific object**
- **In J2SE 5.0, all collection classes are rewritten to be generic classes**

*Vector<String> vs = new Vector<String>();*

*vs.add(new Integer(5)); // Compile error!*

*vs.add(new String("hello"));*

*String s = vs.get(0); // No casting needed*

## Using Generic class (Contd.).

- **Generic class can have multiple type parameters**
- **Type argument can be a custom type**

```
HashMap<String, Mammal> map = new HashMap<String, Mammal>();  
map.put("monkey", new Mammal("monkey"));  
Mammal w = map.get("monkey");
```

# Raw Type

- Generic type instantiated with no type arguments
- Pre-J2SE 5.0 classes continue to function over J2SE 5.0 JVM as raw type

*// Generic type instantiated with type argument*

*List<String> ls = new LinkedList<String>();*

*// Generic type instantiated with no type*

*// argument – Raw type*

*List lraw = new LinkedList();*



# Type Erasure

- Enables Java applications that uses generics to maintain binary compatibility with Java libraries and applications that were created before generics
- So generic type information does not exist during runtime
  - During runtime, the class that represents `ArrayList<String>`, `ArrayList<Integer>` is the same class that represents `ArrayList`

## Type Erasure Example code: True / False

```
ArrayList<Integer> ai = new ArrayList<Integer>();  
ArrayList<String> as = new ArrayList<String>();  
Boolean b1 = (ai.getClass() == as.getClass());  
System.out.println(" Do ArrayList<Integer> and ArrayList<String>  
share same class ? " + b1);
```

*O/P:*

*Do ArrayList<Integer> and ArrayList<String> share same class? true*

## Interoperability with pre J2SE 5 code

- For raw type, compiler does not have enough type information (for type checking) so it just generates “unchecked” or “unsafe” warning
- If you ignore them, `ClassCastException` can still occur during runtime

```
List<String> ls = new LinkedList<String>();
```

```
List lraw = ls;
```

```
lraw.add(new Integer(4)); // Compiler Warning
```

```
String s = ls.iterator().next(); // Runtime error
```

# Recommendations

- Do not use raw type whenever possible
- If you have to use raw type or have to use pre-J2SE 5.0 compiled classes or libraries, make sure the “*unsafe*” compile warnings are really just warnings

# AutoBoxing with Collections

- **Boxing conversion converts primitive values to objects of corresponding wrapper types**

// prior to Java 5, Explicit Boxing

```
int i = 11;
```

```
Integer iReference = new Integer(i);
```

// In Java 5, Automatic Boxing

```
iReference = i;
```

- **Unboxing conversion converts objects of wrapper types to values of corresponding primitive types**

// prior to Java 5, Explicit Unboxing

```
int j = iReference.intValue();
```

```
j = iReference; // In Java 5, Automatic Unboxing
```

# AutoBoxing with Collections

- J2SE 5 adds to the java language autoboxing and auto-unboxing.
- Primitive types and their corresponding wrapper classes can now be used interchangeably.

For example the following lines of code are legitimate in Java 5 : `int a = 0;`

- `Integer b = a; //`
- `int c = new Integer(b);`
- This is often referred to as automatic *boxing* or *unboxing*.

## AutoBoxing with Collections

- If an *int* is passed where an Integer is expected, the compiler will automatically insert a call to the Integer constructor. Conversely, if an Integer is provided where an *int* is required, there will be an automatic call to the intValue method.
- Autoboxing is the process by which a primitive type is automatically encapsulated into its equivalent type wrapper whenever an object of that type is needed.
- Auto-unboxing is the process by which the value of a boxed object is automatically extracted (unboxed ) from type wrapper when its value is needed.



## Quiz

1. Which of the following are true regarding Generics?

- a. It lets you enforce compile-time safety on collections
- b. When using collections, a cast is needed to get elements out of the Collection
- c. Both option a and option b are true
- d. None of the above are true

2. Will the following code compile?

```
List<Animal> aList = new ArrayList<Animal>();
```

- a. True
- b. False



# Summary

- Generics



# Thank You