String & File

Agenda:

Java String Handling
Java File Handling

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String in java is not a primitive/derived type in rather String represent object of String class in java

Reference Text: Chap. - 16,17

String Handling

CHAPTER 16 String Handling

CHAPTER 17 Exploring java.lang

Keywords:

Java String

String Pool

Creating a String

String Methods

String Builder Vs String Buffer

- Part I: The Java Language
- Part II: The Java Library
  - Chapter 16: String Handling
  - Chapter 17: Exploring java.lang

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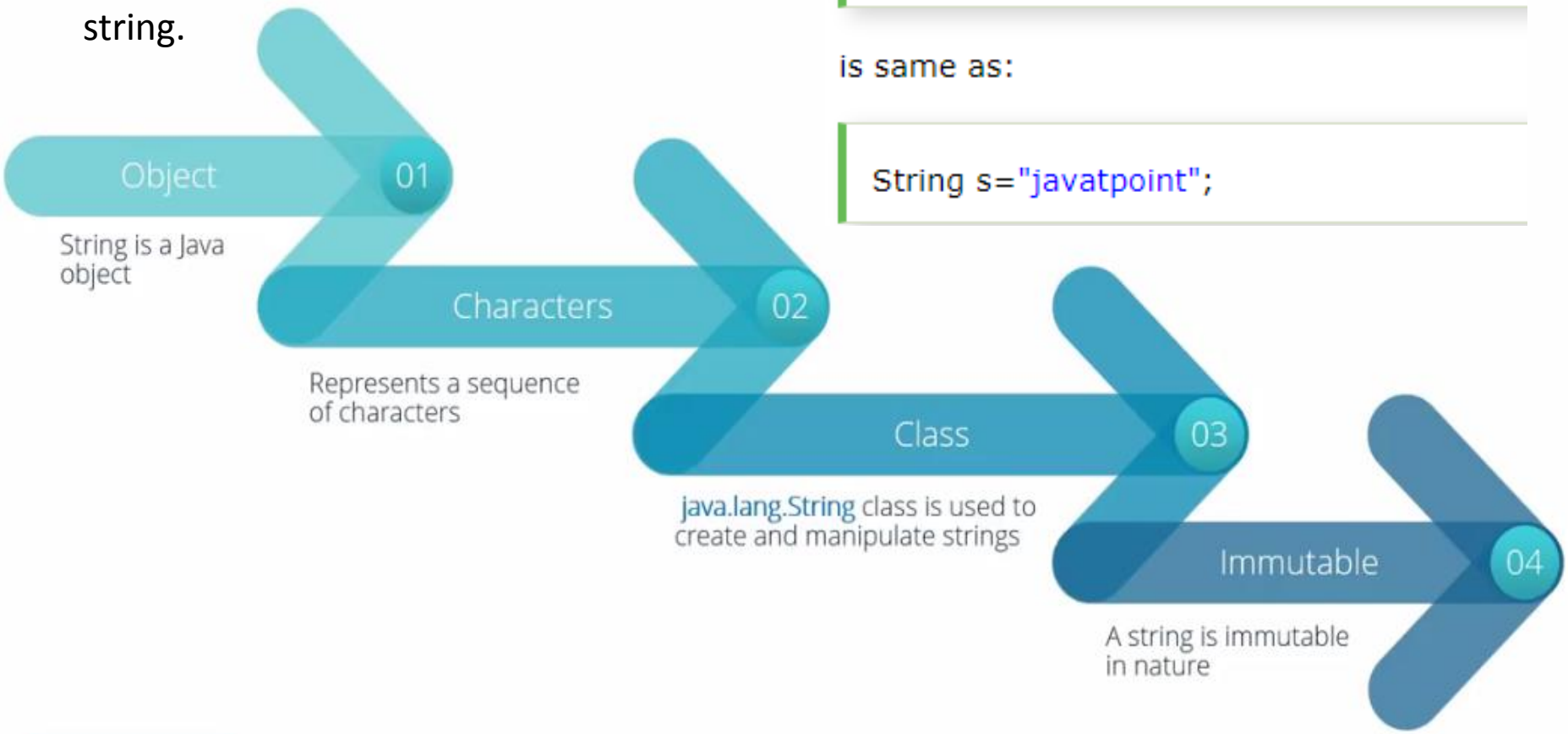
Java String

In Java, string is basically an object that represents sequence of char values. An array of characters works same as Java string.

```
char[] ch={'j','a','v','a','t','p','o','i','n','t'};
String s=new String(ch);
```

is same as:

```
String s="javatpoint";
```



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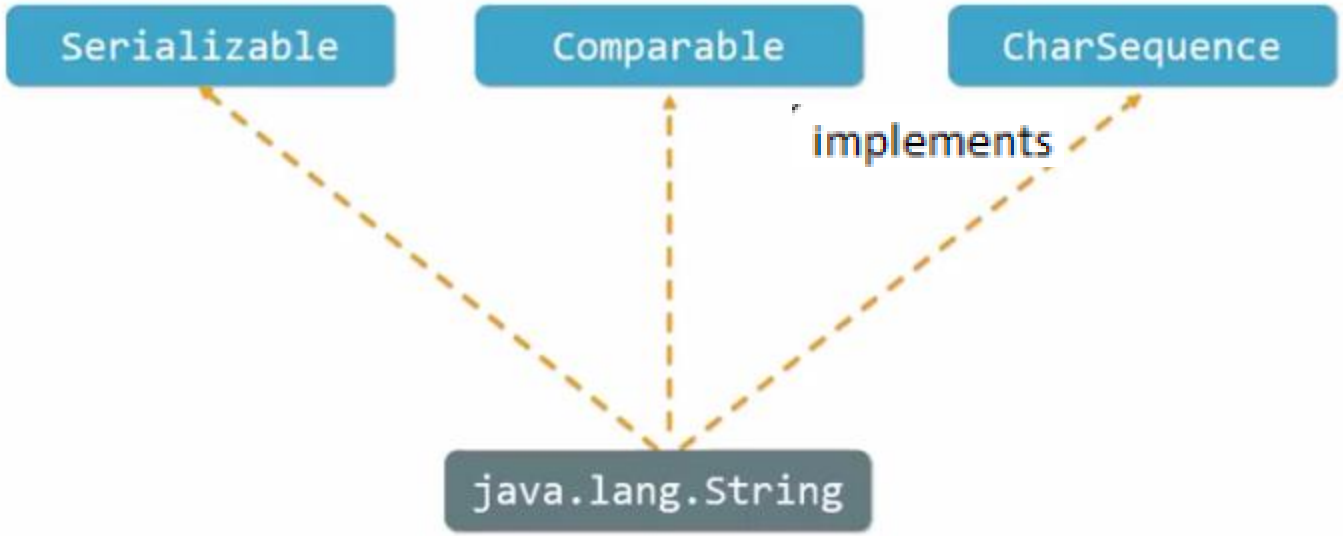
Java String

The java.lang.String class
implements *Serializable*, *Comparable* and *CharSequence* interfaces.




```
public final class String
    extends Object
        implements Serializable, Comparable<String>, CharSequence
```

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Java String

Serializable

Serializable is a marker interface that contains no data member or method. It is used to "mark" the java classes so that objects of these classes may get a specific capability

Comparable

Comparable interface is used for ordering the objects of any user-defined class. This interface is found in **`java.lang.package`** and contains only one method named **`compareTo(Object)`**

CharSequence

A CharSequence interface is a readable sequence of characters. This interface provides uniform, read-only access to various kind of character sequences

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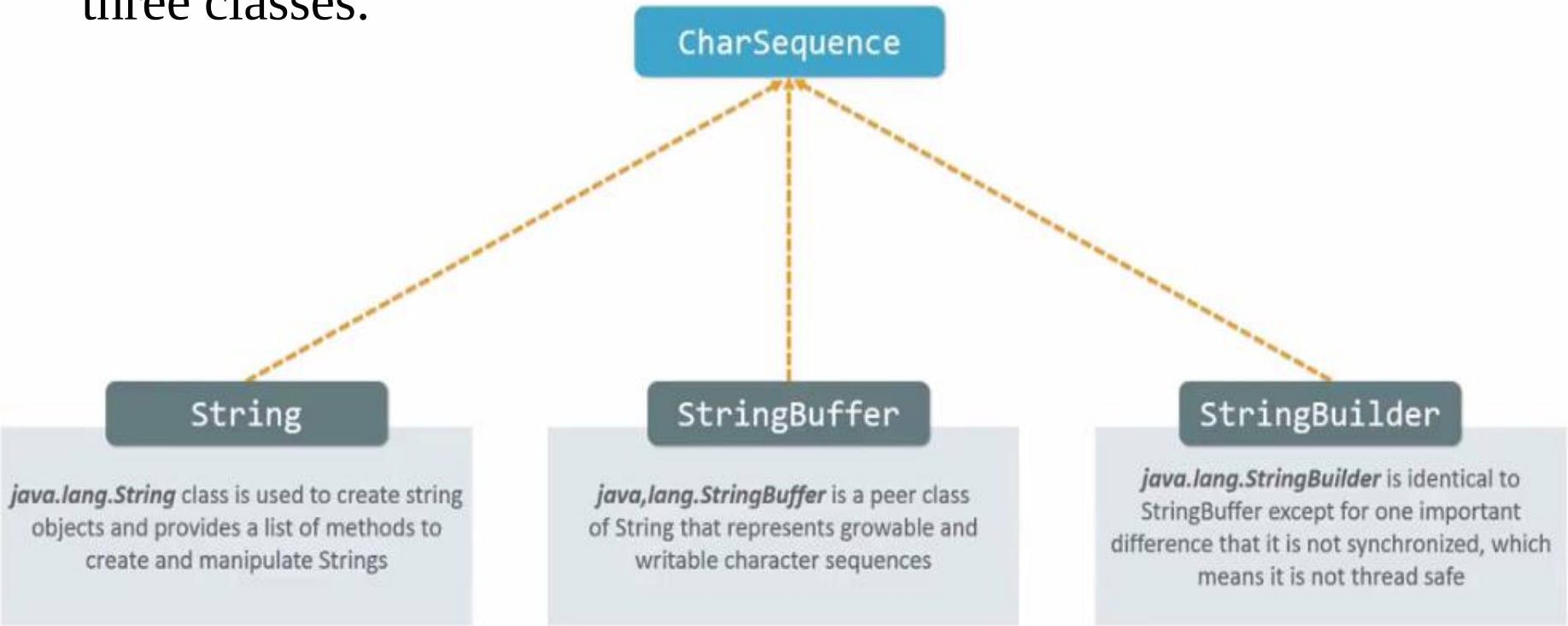
Java String: CharSequence interface

The CharSequence interface is used to represent the sequence of characters. String, StringBuffer and StringBuilder classes implement it. It means, we can create strings in java by using these three classes.



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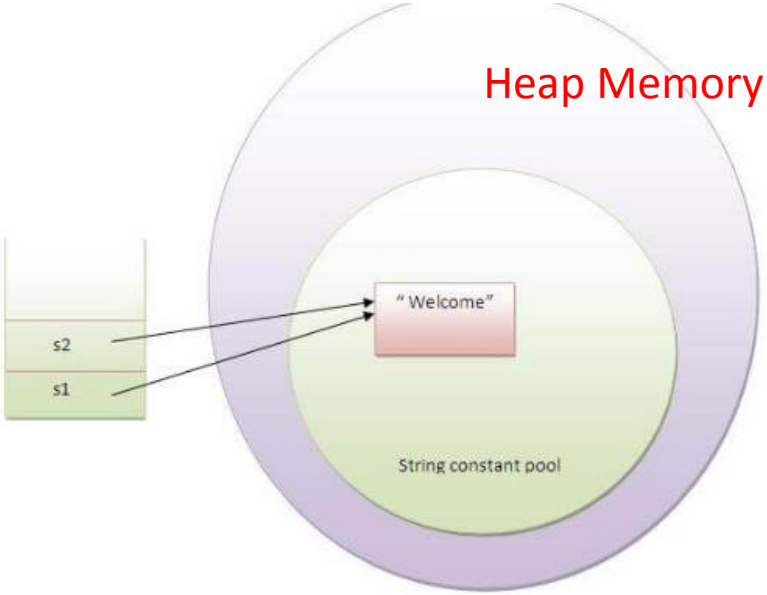
Creating String : Pool

How to create a string object?

There are two ways to create String object:

1. By string literal
2. By new keyword

```
String s1="Welcome";
String s2="Welcome";//It doesn't create a new instance
```



Each time you create a string literal, the JVM checks the "string constant pool" first. If the string already exists in the pool, a reference to the pooled instance is returned. If the string doesn't exist in the pool, a new string instance is created and placed in the pool

Note: String objects are stored in a special memory area known as the "string constant pool".

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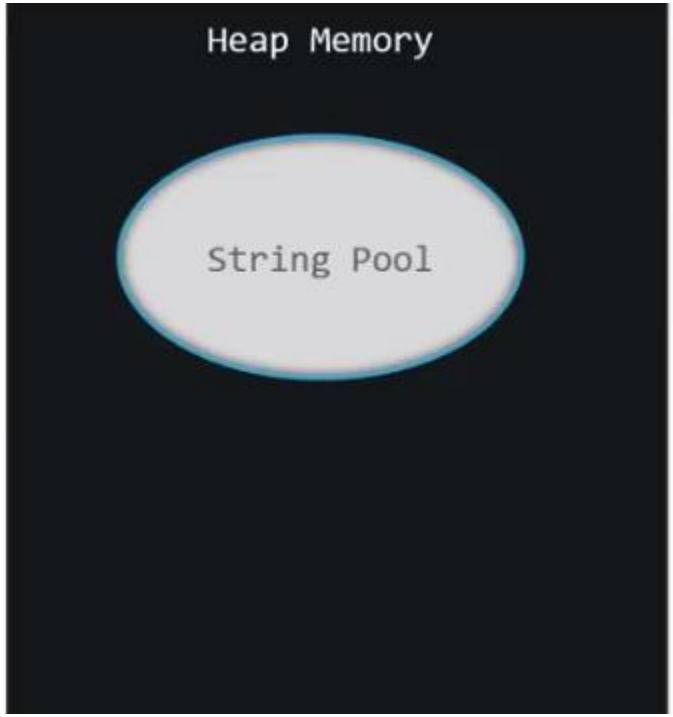
String Constant Pool

The Java String is immutable which means it cannot be changed. Whenever we change any string, a new instance is created. For mutable strings, you can use StringBuffer and StringBuilder classes.

- Java String pool refers to collection of Strings which are stored in heap memory
- As String objects are immutable in nature the concept of String Pool came into the picture
- String Pool helps in saving space for Java Runtime



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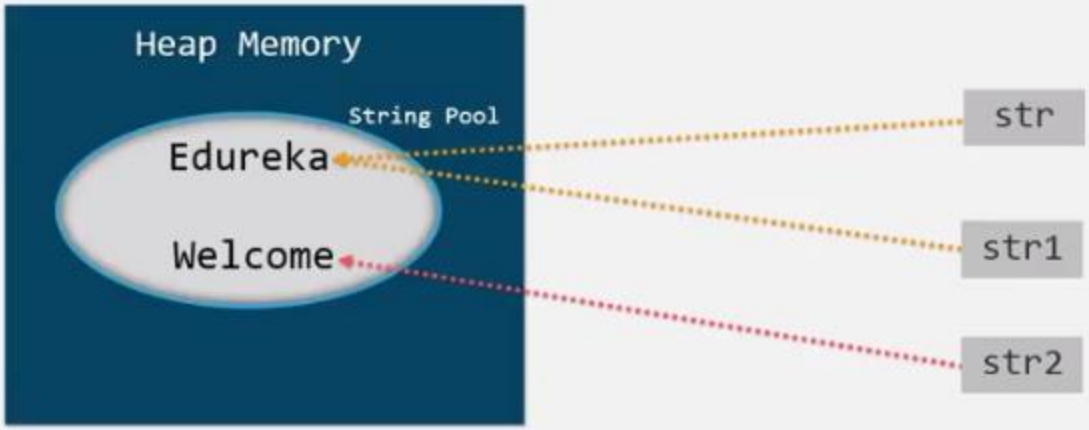
Creating String using literal

Java String literal is created by using double quotes

```
String str = "Edureka";
```

Before creating a String literal first looks for String with same value in the String pool, if found it returns the reference else it creates a new String in the pool & returns the reference




```
String str1 = "Edureka";
String str2 = "Welcome";
```

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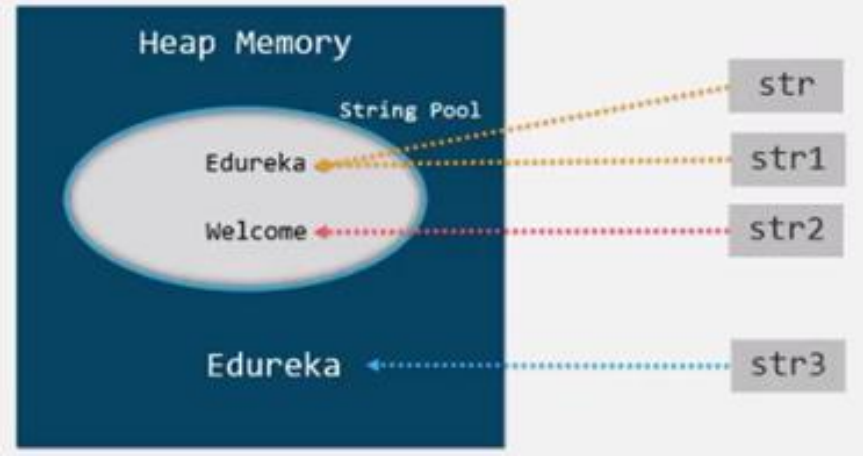
Creating String using new keyword

In such case, JVM will create a new string object (“Edureka”) in normal (non-pool) heap memory, and the literal “Edureka" will be placed in the string constant pool. The variables will refer to the object in a heap (non-pool).

String object created using “new” keyword it always create a new object in heap memory

```
String str = new String (“Edureka”);
```



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String : Example

```
public class StringExample{
public static void main(String args[]){
String s1="java";//creating string by java string literal
char ch[]={'s','t','r','i','n','g','s'};
String s2=new String(ch);//converting char array to string
String s3=new String("example");//creating java string by new keyword
System.out.println(s1);
System.out.println(s2);
System.out.println(s3);
}}
```

```
java
strings
example
```

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String Class : Methods

No.	Method	Description
1	char charAt(int index)	returns char value for the particular index
2	int length()	returns string length
3	String substring(int beginIndex)	returns substring for given begin index.
4	String substring(int beginIndex, int endIndex)	returns substring for given begin index and end index.
5	boolean contains(CharSequence s)	returns true or false after matching the sequence of char value.
6	static String join(CharSequence delimiter, CharSequence... elements)	returns a joined string.
7	boolean equals(Object another)	checks the equality of string with the given object.
8	boolean isEmpty()	checks if string is empty.
9	String concat(String str)	concatenates the specified string.

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String Class : Methods

No.	Method	Description
10	String replace(char old, char new)	replaces all occurrences of the specified char value.
11	String replace(CharSequence old, CharSequence new)	replaces all occurrences of the specified CharSequence.
12	String intern()	returns an interned string.
13	int indexOf(int ch)	returns the specified char value index.
14	int indexOf(int ch, int fromIndex)	returns the specified char value index starting with given index.
15	int indexOf(String substring)	returns the specified substring index.
16	int indexOf(String substring, int fromIndex)	returns the specified substring index starting with given index.
17	String toLowerCase()	returns a string in lowercase.
18	String toUpperCase()	returns a string in uppercase.
20	String trim()	removes beginning and ending spaces of this string.

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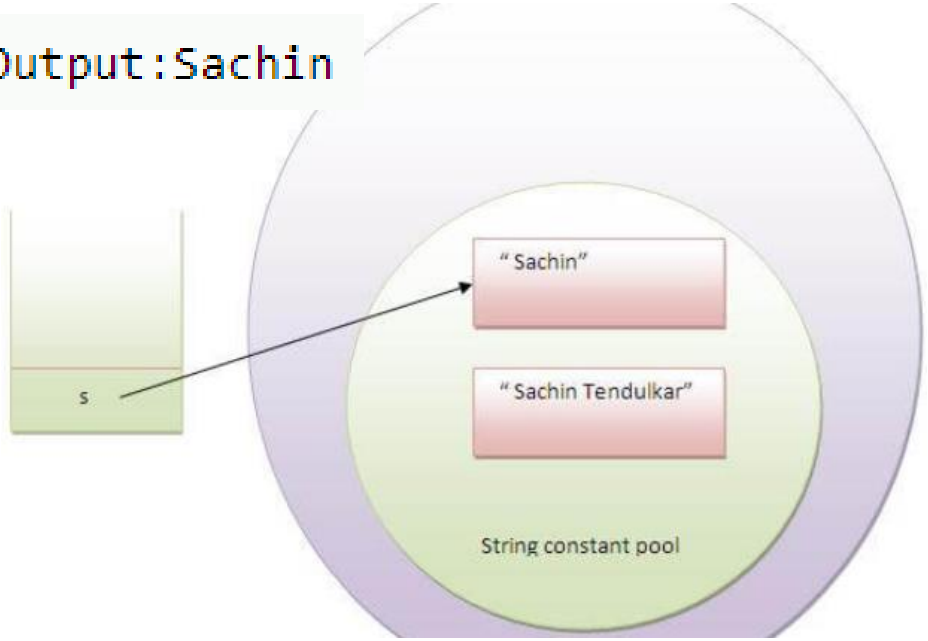
Immutable String in Java

In java, **string objects are immutable**. Immutable simply means unmodifiable or unchangeable. Once string object is created its data or state can't be changed but a new string object is created.

```
class Testimmutablestring{
 public static void main(String args[]){
  String s="Sachin";
  s.concat(" Tendulkar");//concat() method appends the string at the end
  System.out.println(s);//will print Sachin because strings are immutable objects
 }
}
```

```
Output:Sachin
```



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Immutable String in Java

```
class Testimmutablestring1{
 public static void main(String args[]){
  String s="Sachin";
  s=s.concat(" Tendulkar");
  System.out.println(s);
 }
}
```

Test it Now

```
Output:Sachin Tendulkar
```

But if we explicitely assign it to the referen variable, it will refer to "Sachin Tendulk object.For example:

In such case, s points to the "Sachin Tendulkar". Please notice that still sachin object is not modified.

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Why string objects are immutable in java?

Because java uses the concept of string literal.Suppose there are 5 reference variables,all referes to one object "sachin".If one reference variable changes the value of the object, it will be affected to all the reference variables. That is why string objects are immutable in java.

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Java String class methods

```
String s="Sachin";
System.out.println(s.toUpperCase());//SACHIN
System.out.println(s.toLowerCase());//sachin
System.out.println(s);//Sachin(no change in original)
```

```
SACHIN
sachin
Sachin
```

```
String s="  Sachin  ";
System.out.println(s);//  Sachin
System.out.println(s.trim());//Sachin
```

```
  Sachin
Sachin
```

```
String s="Sachin";
System.out.println(s.startsWith("Sa"));//true
System.out.println(s.endsWith("n"));//true
```

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Java String class methods

```
String s="Sachin";
System.out.println(s.charAt(0));//S
System.out.println(s.charAt(3));//h
```

```
String s="Sachin";
System.out.println(s.length());//6
```

```
String s1="Java is a programming language. Java is a platform. Java is an Island.";
String replaceString=s1.replace("Java","Kava");//replaces all occurrences of "Java" to "Kava"
System.out.println(replaceString);
```

```
Kava is a programming language. Kava is a platform. Kava is an Island.
```

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Mutable String in Java : StringBuffer

Java StringBuffer class is used to create mutable (modifiable) string. The StringBuffer class in java is same as String class except it is mutable i.e. it can be changed.

```
class StringBufferExample{
public static void main(String args[]){
StringBuffer sb=new StringBuffer("Hello ");
sb.append("Java");//now original string is changed
System.out.println(sb);//prints Hello Java
}
}
```

Note: Java StringBuffer class is thread-safe i.e. multiple threads cannot access it simultaneously. So it is safe and will result in an order.

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Mutable String in Java : StringBuilder

Java StringBuilder class is used to create mutable (modifiable) string. The Java StringBuilder class is same as StringBuffer class except that it is non-synchronized

```
class StringBuilderExample{
public static void main(String args[]){
StringBuilder sb=new StringBuilder("Hello ");
sb.append("Java");//now original string is changed
System.out.println(sb);//prints Hello Java
}
}
```

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Methods: StringBuilder, StringBuffer

Method	Description
public StringBuilder append(String s)	is used to append the specified string with this string. The append() method is overloaded like append(char), append(boolean), append(int), append(float), append(double) etc.
public StringBuilder insert(int offset, String s)	is used to insert the specified string with this string at the specified position. The insert() method is overloaded like insert(int, char), insert(int, boolean), insert(int, int), insert(int, float), insert(int, double) etc.
public StringBuilder replace(int startIndex, int endIndex, String str)	is used to replace the string from specified startIndex and endIndex.
public StringBuilder delete(int startIndex, int endIndex)	is used to delete the string from specified startIndex and endIndex.
public StringBuilder reverse()	is used to reverse the string.
public int capacity()	is used to return the current capacity.
public char charAt(int index)	is used to return the character at the specified position.
public int length()	is used to return the length of the string i.e. total number of characters.
public String substring(int beginIndex)	is used to return the substring from the specified beginIndex.
public String substring(int beginIndex, int endIndex)	is used to return the substring from the specified beginIndex and endIndex.

Methods: StringBuilder, StringBuffer

```
StringBuilder sb=new StringBuilder("Hello ");
sb.insert(1,"Java");//now original string is changed
System.out.println(sb);//prints HJavaello
```

```
StringBuilder sb=new StringBuilder("Hello");
sb.replace(1,3,"Java");
System.out.println(sb);//prints HJavalo
```

```
StringBuilder sb=new StringBuilder("Hello");
sb.delete(1,3);
System.out.println(sb);//prints Hlo
```

```
StringBuilder sb=new StringBuilder("Hello");
sb.reverse();
System.out.println(sb);//prints olleH
```

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Difference : String Vs StringBuffer Vs StringBuilder

No.	String	StringBuffer
1)	String class is immutable.	StringBuffer class is mutable.
2)	String is slow and consumes more memory when you concat too many strings because every time it creates new instance.	StringBuffer is fast and consumes less memory when you cancat strings.
3)	String class overrides the equals() method of Object class. So you can compare the contents of two strings by equals() method.	StringBuffer class doesn't override the equals() method of Object class.

No.	StringBuffer	StringBuilder
1)	StringBuffer is *synchronized* i.e. thread safe. It means two threads can't call the methods of StringBuffer simultaneously.	StringBuilder is *non-synchronized* i.e. not thread safe. It means two threads can call the methods of StringBuilder simultaneously.
2)	StringBuffer is *less efficient* than StringBuilder.	StringBuilder is *more efficient* than StringBuffer.

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Performance: StringBuffer Vs StringBuilder

```java
public class ConcatTest{
    public static void main(String[] args){
        long startTime = System.currentTimeMillis();
        StringBuffer sb = new StringBuffer("Java");
        for (int i=0; i<10000; i++){
            sb.append("Tpoint");
        }
        System.out.println("Time taken by StringBuffer: " + (System.currentTimeMillis() - startTime) + "ms");
        startTime = System.currentTimeMillis();
        StringBuilder sb2 = new StringBuilder("Java");
        for (int i=0; i<10000; i++){
            sb2.append("Tpoint");
        }
        System.out.println("Time taken by StringBuilder: " + (System.currentTimeMillis() - startTime) + "ms");
    }
}
```

```
Time taken by StringBuffer: 16ms
Time taken by StringBuilder: 0ms
```

StringTokenizer Class in Java

```
import java.util.StringTokenizer;
public class Simple{
 public static void main(String args[]){
   StringTokenizer st = new StringTokenizer("my name is khan"," ");
     while (st.hasMoreTokens()) {
        System.out.println(st.nextToken());
     }
   }
}
```

```
Output:my
       name
       is
       khan
```

StringTokenizer class is deprecated now. It is recommended to use split() method of String class or regex (Regular Expression).

File Handling

Agenda:

- File Handling Basics
- Create a File
- Write into a File
- Read From a File
- Delete a file

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The File class from the java.io package, allows us to work with files.

Java File Handling

- The File class from the java.io package, allows us to work with files.
- To use the File class, create an object of the class, and specify the filename or directory name:

Example

```
import java.io.File;  // Import the File class

File myObj = new File("filename.txt"); // Specify the filename
```

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File Methods

- The File class has many useful methods for creating and getting information about files. For example

Method	Type	Description
canRead()	Boolean	Tests whether the file is readable or not
canWrite()	Boolean	Tests whether the file is writable or not
createNewFile()	Boolean	Creates an empty file
delete()	Boolean	Deletes a file
exists()	Boolean	Tests whether the file exists
getName()	String	Returns the name of the file
getAbsolutePath()	String	Returns the absolute pathname of the file
length()	Long	Returns the size of the file in bytes
list()	String[]	Returns an array of the files in the directory
mkdir()	Boolean	Creates a directory

File: Create a File

- To create a file in Java, you can use the createNewFile() method. This method returns a boolean value: true if the file was successfully created, and false if the file already exists.

```java
import java.io.File;  // Import the File class
import java.io.IOException;  // Import the IOException class to handle errors

public class CreateFile {
  public static void main(String[] args) {
    try {
      File myObj = new File("filename.txt");
      if (myObj.createNewFile()) {
        System.out.println("File created: " + myObj.getName());
      } else {
        System.out.println("File already exists.");
      }
    } catch (IOException e) {
      System.out.println("An error occurred.");
      e.printStackTrace();
    }
  }
}
```

Note that the method is enclosed in a try...catch block. This is necessary because it throws an IOException if an error occurs (if the file cannot be created for some reason):

The output will be:

```
File created: filename.txt
```

Create a file in a specific directory

- To create a file in a specific directory (requires permission), specify the path of the file and use double backslashes to escape the "\" character (for Windows). On Mac and Linux you can just write the path, like: /Users/name/filename.txt

Example

```
File myObj = new File("C:\\Users\\MyName\\filename.txt");
```

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Write To a File

- In the following example, we use the FileWriter class together with its write() method to write some text to the file we created in the example above. Note that when you are done writing to the file, you should close it with the close() method:

```java
import java.io.FileWriter;   // Import the FileWriter class
import java.io.IOException;  // Import the IOException class to handle errors

public class WriteToFile {
  public static void main(String[] args) {
    try {
      FileWriter myWriter = new FileWriter("filename.txt");
      myWriter.write("Files in Java might be tricky, but it is fun enough!");
      myWriter.close();
      System.out.println("Successfully wrote to the file.");
    } catch (IOException e) {
      System.out.println("An error occurred.");
      e.printStackTrace();
    }
  }
}
```

The output will be:

```
Successfully wrote to the file.
```

File: Get File Information

- To get more information about a file, use any of the File methods:

```java
import java.io.File;  // Import the File class

public class GetFileInfo {
  public static void main(String[] args) {
    File myObj = new File("filename.txt");
    if (myObj.exists()) {
      System.out.println("File name: " + myObj.getName());
      System.out.println("Absolute path: " + myObj.getAbsolutePath());
      System.out.println("Writeable: " + myObj.canWrite());
      System.out.println("Readable " + myObj.canRead());
      System.out.println("File size in bytes " + myObj.length());
    } else {
      System.out.println("The file does not exist.");
    }
  }
}
```

The output will be:

```
File name: filename.txt
Absolute path: C:\Users\MyName\filename.txt
Writeable: true
Readable: true
File size in bytes: 0
```

File: Delete Files

- To delete a file in Java, use the delete() method

```java
import java.io.File;  // Import the File class

public class DeleteFile {
  public static void main(String[] args) {
    File myObj = new File("filename.txt");
    if (myObj.delete()) {
      System.out.println("Deleted the file: " + myObj.getName());
    } else {
      System.out.println("Failed to delete the file.");
    }
  }
}
```

The output will be:

```
Deleted the file: filename.txt
```

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File: Delete a Folder

- You can also delete a folder. However, it must be empty

```java
import java.io.File;

public class DeleteFolder {
  public static void main(String[] args) {
    File myObj = new File("C:\\Users\\MyName\\Test");
    if (myObj.delete()) {
      System.out.println("Deleted the folder: " + myObj.getName());
    } else {
      System.out.println("Failed to delete the folder.");
    }
  }
}
```

The output will be:

```
Deleted the folder: Test
```

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File: Create a File

- The File class has many useful methods for creating and getting information about files. For example