Object Oriented Programming using Java

Comprehensive overview of Java

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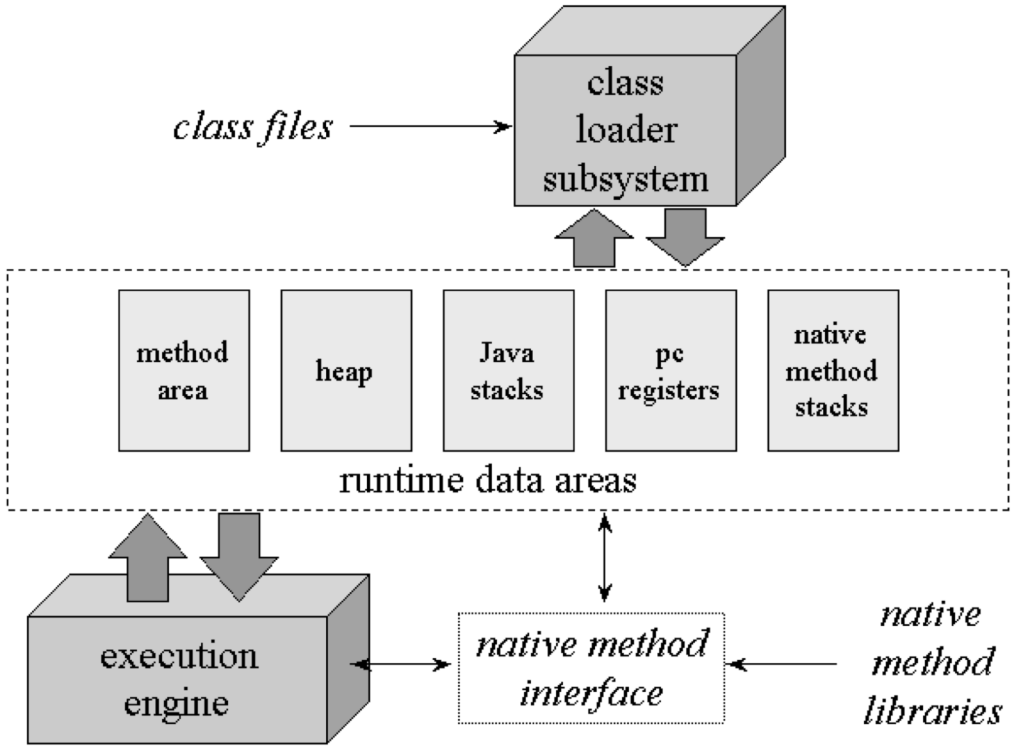
Session Overview

- Components of JVM
- Java Buzzwords
- Java Modifier
- Access Modifier
- Java Virtual Machine Threads
- Entry Point Method
- Meaning of System.out.println
- Data Types
- Classification of Data Types
- Primitive Data Types
- Wrapper Class Hierarchy
- Overview of String
- Memory representation
- Widening Conversion
- Narrowing Conversion
- Boxing
- UnBoxing
- Command line Arguments

Components of JVM

- **Class loader subsystem**
    1. Bootstrap class loader
    2. Extension class loader
    3. System class loader
    4. Custom class loader
- **Runtime data areas**
    1. Method area
    2. Heap
    3. Java Stacks
    4. PC Register
    5. Native method stacks
- **Execution engine**
    1. Interpreter
    2. Just In Time Compiler
    3. Garbage Collector



Java Buzzwords

- *Java Buzzwords* are Java language marketing words.

1. Simple
2. Object Oriented
3. Architecture Neutral
4. Portable
5. Robust
6. Dynamic
7. Multithreaded
8. Secure
9. High Performance
10. Distributed

Java Modifier

- A keyword which is used to change the behavior of variable, field, method, class etc.
- There are 12 modifiers in Java:

1. private : Access Modifier
2. protected : Access Modifier
3. public : Access Modifier
4. static : Non Access Modifier
5. final : Non Access Modifier
6. abstract : Non Access Modifier
7. interface : Non Access Modifier
8. transient : Non Access Modifier
9. synchronized : Non Access Modifier
10. volatile : Non Access Modifier
11. strictfp : Non Access Modifier
12. native : Non Access Modifier

Access Modifier

- Modifier which is used to control visibility of the members of the class/enum/interface.
- 4 Access modifiers in Java
    1. private
    2. package level private(also called as default)
    3. protected
    4. public

	Same Package			Different Package	
Access Modifier	**Same Class**	**Sub Class**	**Non Sub Class**	**Sub Class**	**Non Sub Class**
private	A	NA	NA	NA	NA
package level private	A	A	A	NA	NA
protected	A	A	A	A	NA
public	A	A	A	A	A

Java Virtual Machine Threads

```
sandeep@Sandeeps-MacBook-Air Day_1.1 % cat Program.java
class Program{
    public static void main( String[] args )throws Exception{
        System.out.println("Press any key to continue...");
        System.in.read( );
    }
}
sandeep@Sandeeps-MacBook-Air Day_1.1 %
sandeep@Sandeeps-MacBook-Air Day_1.1 % jcmd
44201 sun.tools.jcmd.JCmd
44173 Program
sandeep@Sandeeps-MacBook-Air Day_1.1 %
sandeep@Sandeeps-MacBook-Air Day_1.1 % jstack 44173
```

Java Virtual Machine Threads

1. Attach Listener
    - A daemon thread responsible for handling the attachment of debuggers.
2. Service Thread
    - A daemon thread that handles JVM service tasks
3. C2 CompilerThread0
4. C2 CompilerThread1
5. C1 CompilerThread2
    - These are compiler threads responsible for compiling Java bytecode to native code.
6. Signal Dispatcher
    - A daemon thread that handles OS signals.
7. Main
    - main application thread.
8. VM Thread
    - A JVM thread used for internal JVM tasks.
9. GC task thread#0 (ParallelGC)
10. GC task thread#1 (ParallelGC)
11. GC task thread#2 (ParallelGC)
12. GC task thread#3 (ParallelGC)
    - Threads dedicated to garbage collection

Entry Point Method

- "main" method is considered as entry point method in java.

- Legal main method signatures
  1. public static void main(string[] args)
  2. public static void main(string args[ ])
  3. public static void main(string. . . args)

- Java compiler do not call main method. With the help of main thread JVM invoke main method in Java.

- If we try to execute class which do not contain main method then we get below error:
  - **Error: Main method not found in class Program, please define the main method as:**
    public static void main(String[] args)

- We can overload main method in Java.

Meaning of System.out.println

```java
package java.lang;
import java.io.*;

public final class System {
  public final static InputStream in = null;
  public final static PrintStream out = null;
  public final static PrintStream err = null;

  public static void exit(int status) {
      Runtime.getRuntime().exit(status);
  }

  public static void gc() {
      Runtime.getRuntime().gc();
  }
}
```

```java
package java.io;

public class PrintStream {

    public void print(String s) {
        // Method to print a string without a newline
    }

    // Other overloaded print(...) methods

    public void println(String s) {
        // Method to print a string followed by a newline
    }

    // Other overloaded println(...) methods

    public PrintStream printf(String format, Object... args) {
        // Method to print formatted strings
        return this;
    }

    // Other overloaded printf() methods
}
```

Data Types

- Java is statically as well as strongly typed language.

- Data Type of any variable describes following properties:
  - **Memory Allocation:** How much memory is required to store the data?
  - **Type of Data:** What kind of data is allowed to store inside variable?
  - **Operation:** Which operations can be performed on the data stored in memory?
  - **Range of data:** Range of values that can be stored in a variable?

- Classification of data types:
  1. **Primitive Data Types**(also called as value types)
  2. **Non Primitive Data Types**(also called as reference types)

Classification of Data Types

- Primitive Data Types
    1. boolean
    2. byte
    3. char
    4. short
    5. int
    6. float
    7. double
    8. Long

- Variable of above type can contain only value. Hence such type is also called as value type.
- Reference: https://docs.oracle.com/javase%2Ftutorial%2F/java/nutsandbolts/datatypes.html

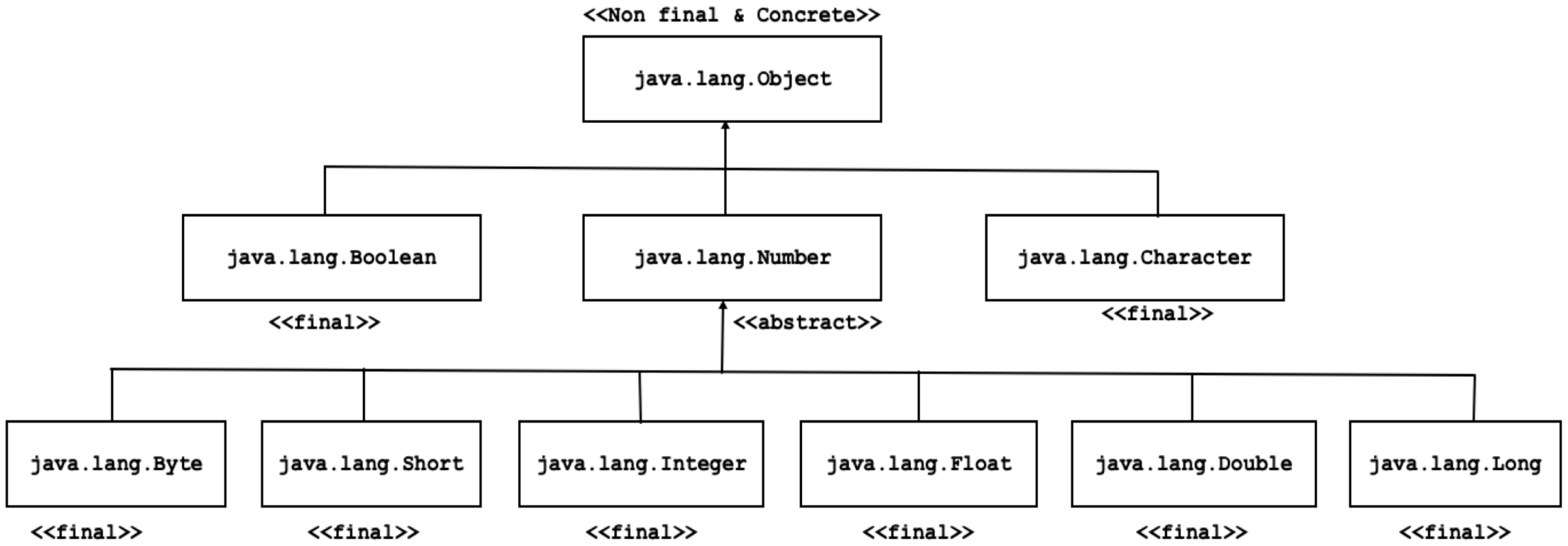
- Non Primitive Data Types
    1. Interface
    2. Class
    3. Array
    4. Enum

- Variable of above type can contain only object reference/reference. Hence such type is also called as reference type.
- Reference: https://docs.oracle.com/javase/tutorial/reflect/class/index.html

Primitive Data Types

Sr.No.	Primitive Type	Size(In Bytes)	Default Value(For Fields)	Wrapper Class
1	boolean	Not defined	false	java.lang.Boolean
2	byte	1	0	java.lang.Byte
3	char	2	'\u0000'	java.lang.Character
4	short	2	0	java.lang.Short
5	int	4	0	java.lang.Integer
6	float	4	0.0f	java.lang.Float
7	double	8	0.0d	java.lang.Double
8	long	8	0L	java.lang.Long

Wrapper Class Hierarchy



Overview of String

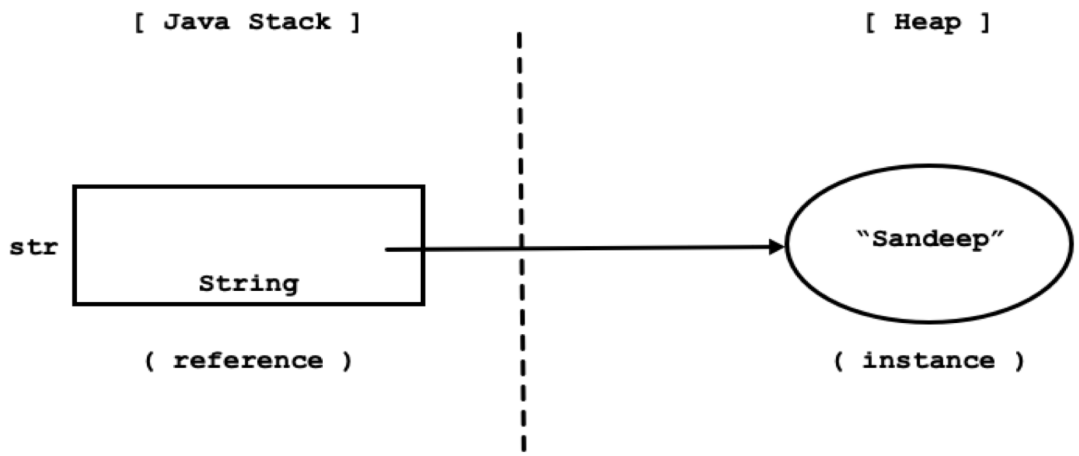
- String is not a primitive / built-in type in Java.
- String is a final class declared in java.lang package.
- Since String is a class, it is considered as non primitive type/reference type.
- We can create Instance of String using new operator as well as without new operator.

- Example 1:
  - String str = new String(“Sandeep”); //OK
    - **str** is called as object reference / simply reference.
    - **new String(“Sandeep”)** is called as instance.

- Example 2:
  - String str = “Sandeep”; //OK
    - **str** is called as object reference / simply reference.
    - “**Sandeep**” is called as String constant/literal.

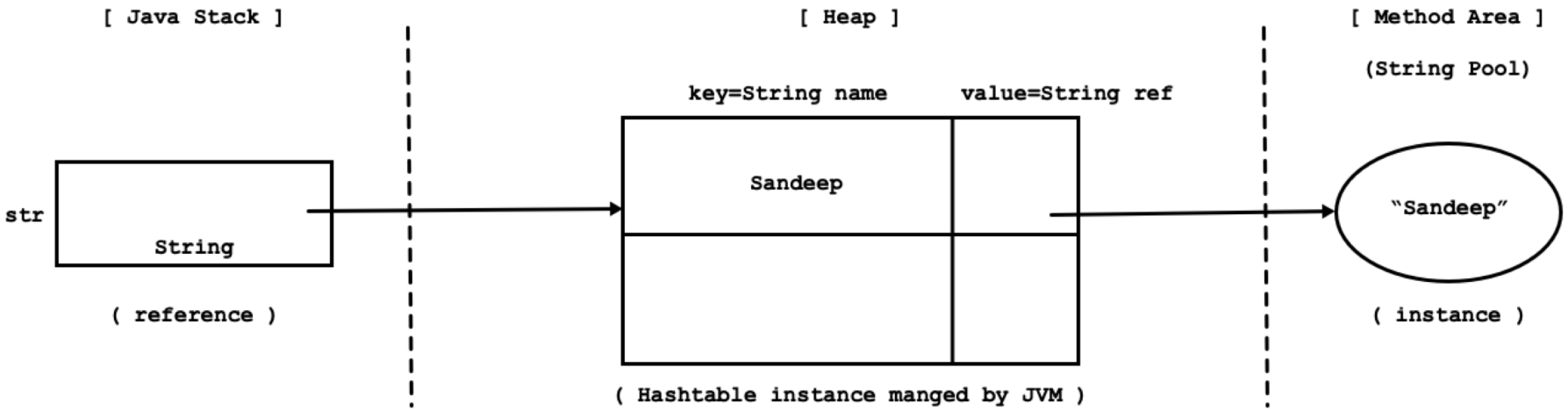
Memory Representation

- Example 1:
  - String str = new String(“Sandeep”); //OK
    - **str** is called as object reference / simply reference.
    - **new String(“Sandeep”)** is called as instance.



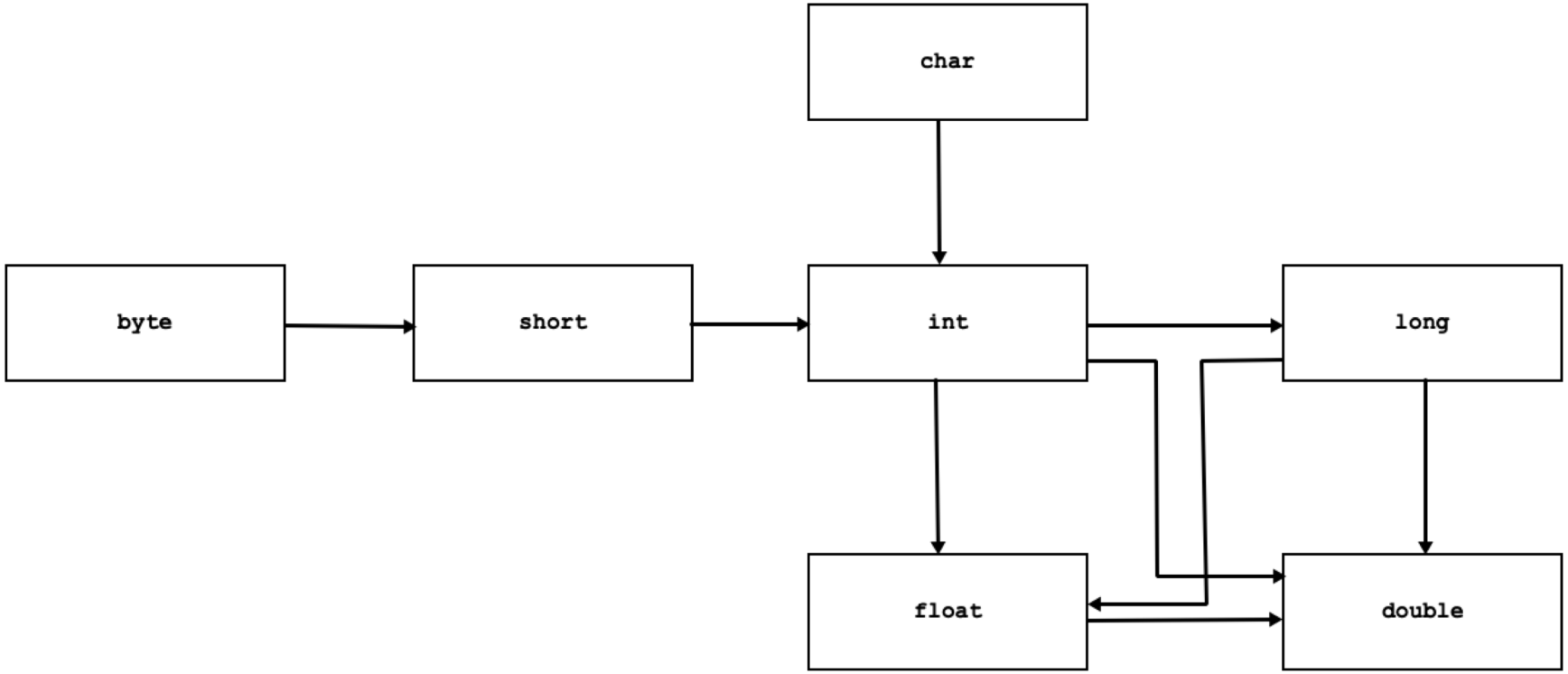
Memory Representation

- Example 2:
  - String str = “Sandeep”; //OK
    - **str** is called as object reference / simply reference.
    - “**Sandeep**” is called as String constant/literal.



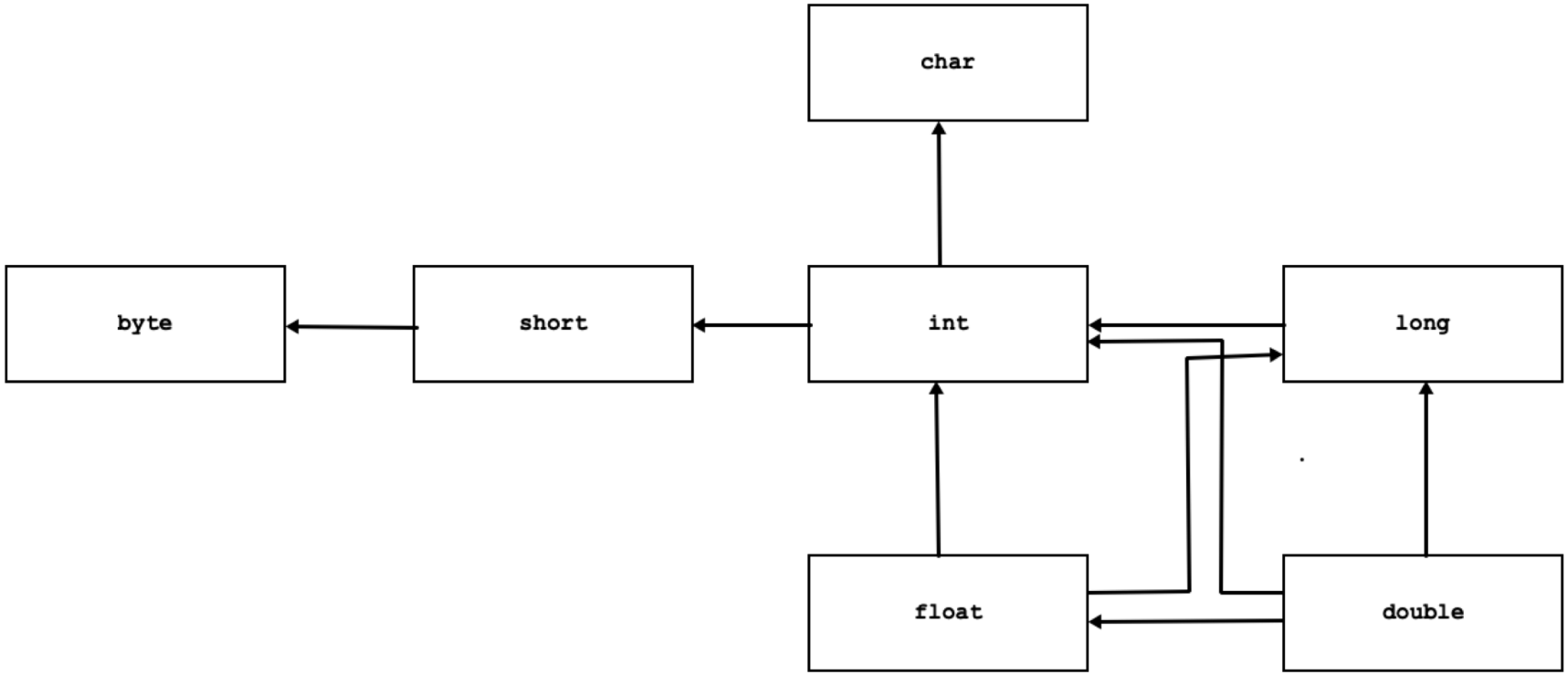
Widening Conversion

- Process of converting value of variable of narrower type into wider type is called as widening.



Narrowing Conversion

- Process of converting value of variable of wider type into narrower type is called as narrowing.



Boxing

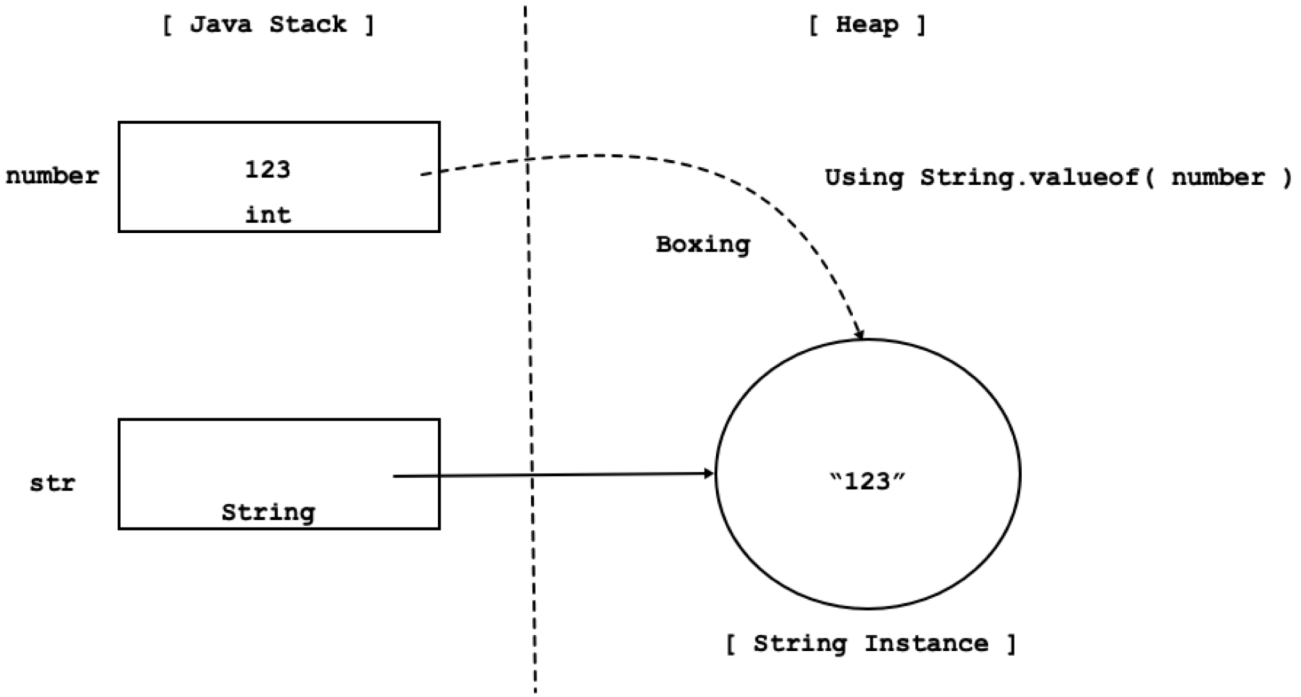
- Using toString() method of Wrapper class or String.valueOf() method, we can convert value of any primitive type into String.

1. String s1 = Boolean.toString(true); **or** String s1 = String.valueOf(true);
2. String s2 = Character.toString('A'); **or** String s2 = String.valueOf('A');
3. String s3 = Integer.toString(123); **or** String s3 = String.valueOf(123);
4. String s4 = Float.toString(123.45f); **or** String s4 = String.valueOf(123.45f);
5. String s5 = Double.toString(123.45d); **or** String s5 = String.valueOf(123.45d);

Boxing

- Boxing is the process of converting value of variable of primitive type into non primitive type.

```
int number = 123;
String str = String.valueOf( number ); //Boxing
```



Unboxing

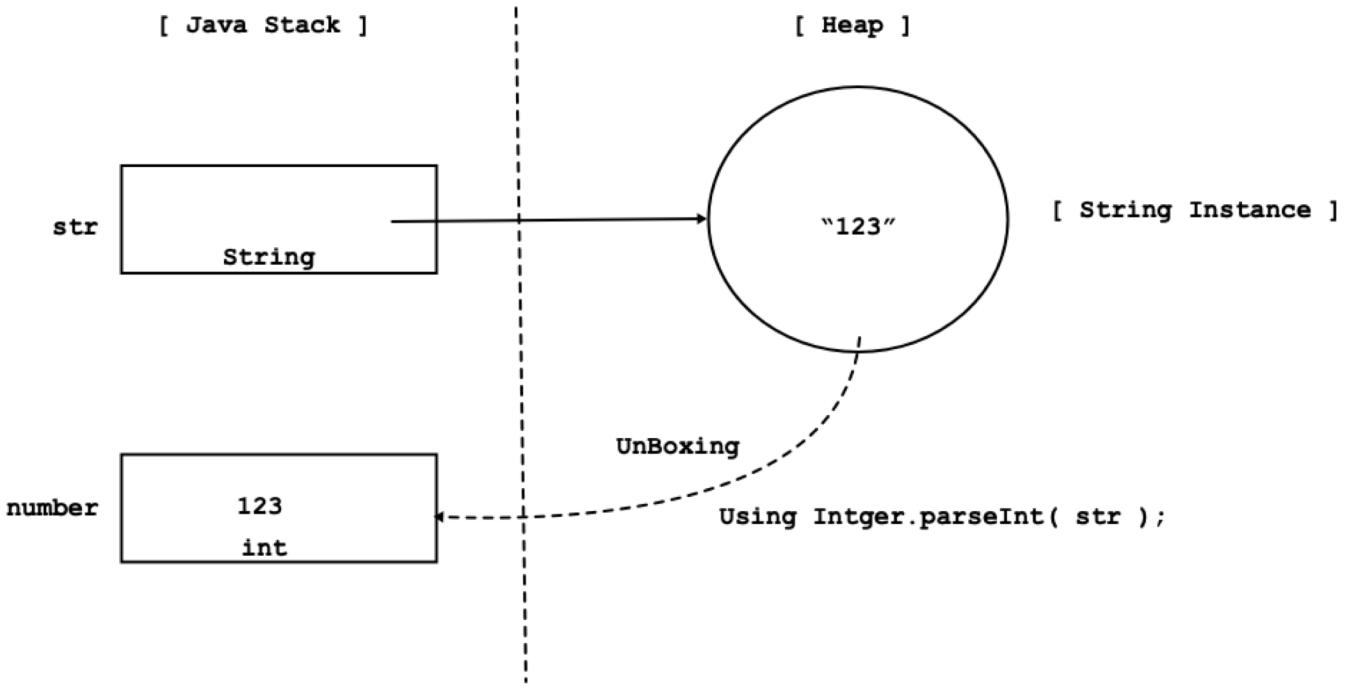
- Using parseXXX() method of Wrapper class, we can convert state of String into primitive value.

```
1. boolean b = Boolean.parseBoolean(“true”);

2. int i = Integer.parseInt( “123” );

3. float f = Float.parseFloat( “123.45f” );

4. double d = Double.parseDouble( “123.45d” );

5. int number = Integer.parseInt( “1A2b3C” );//NumberFormatException
```

Unboxing

- Unboxing is the process of converting value of variable of non primitive type into primitive type.

```
String str = "123";
int number = Integer.parseInt( str ); //UnBoxing
```



Command line Arguments

Program.java

Program.java > Program > main(String[])

```java
class Program{
  public static void main(String[] args){
    System.out.println( args[ 0 ] );
  }
}
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

zsh

```
sandeep@Sandeeps-MacBook-Air Day_1 % javac Program.java
sandeep@Sandeeps-MacBook-Air Day_1 % java Program Hello
Hello
sandeep@Sandeeps-MacBook-Air Day_1 %
```

Command line Arguments

Program.java

Program.java > Program > main(String[])

```java
class Program{
  public static void main(String[] args){
    System.out.println( args[ 0 ] );
    System.out.println( args[ 1 ] );
  }
}
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

zsh

```
sandeep@Sandeeps-MacBook-Air Day_1 % javac Program.java
sandeep@Sandeeps-MacBook-Air Day_1 % java Program 10 20
10
20
sandeep@Sandeeps-MacBook-Air Day_1 %
```

Command line Arguments

Program.java 2

Program.java > Program

```java
class Program{
  public static void main(String[] args){
    int num1 = args[ 0 ];
    int num2 = args[ 1 ];
    int result = num1 + num2;
    System.out.println("Result::"+result);
  }
}
```

PROBLEMS 2 OUTPUT DEBUG CONSOLE TERMINAL PORTS

zsh

```
sandeep@Sandeeps-MacBook-Air Day_1 % javac Program.java
Program.java:3: error: incompatible types: String cannot be converted to int
    int num1 = args[ 0 ];
               ^
Program.java:4: error: incompatible types: String cannot be converted to int
    int num2 = args[ 1 ];
               ^
2 errors
sandeep@Sandeeps-MacBook-Air Day_1 %
```

Command line Arguments

Program.java

```java
class Program{
  public static void main(String[] args){
    int num1 = Integer.parseInt( args[ 0 ] );
    int num2 = Integer.parseInt( args[ 1 ] );
    int result = num1 + num2;
    System.out.println("Result::"+result);
  }
}
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
sandeep@Sandeeps-MacBook-Air Day_1 % javac Program.java
sandeep@Sandeeps-MacBook-Air Day_1 % java Program
Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: Index 0 out of bounds for length 0
        at Program.main(Program.java:3)
sandeep@Sandeeps-MacBook-Air Day_1 % java Program 10 20
Result::30
sandeep@Sandeeps-MacBook-Air Day_1 %
```

Command line Arguments

Program.java

Program.java > Program > main(String[])

```java
class Program{
  public static void main(String[] args){
    int num1 = Integer.parseInt( args[ 0 ] );
    float num2 = Float.parseFloat( args[ 1 ] );
    double num3 = Double.parseDouble( args[ 1 ] );
    double result = num1 + num2 + num3;
    System.out.println("Result::"+result);
  }
}
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

zsh

```
sandeep@Sandeeps-MacBook-Air Day_1 % javac Program.java
sandeep@Sandeeps-MacBook-Air Day_1 % java Program 10 20.1f 30.2d
Result::50.20000038146973
sandeep@Sandeeps-MacBook-Air Day_1 %
```


Q
A