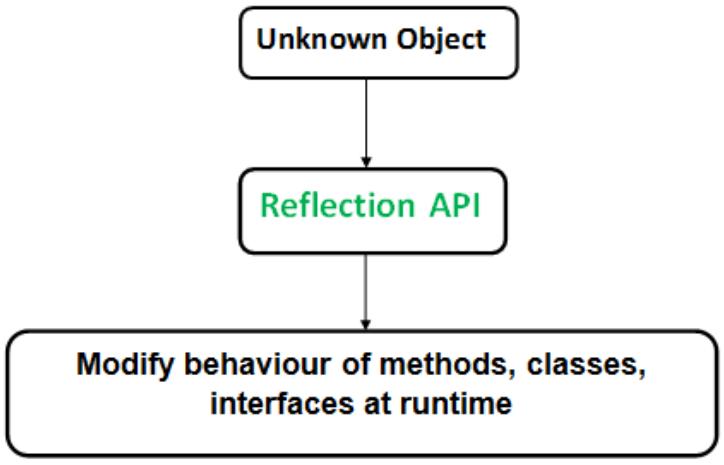
Reflection in Java

Reflection is an API which is used to examine or modify the behavior of methods, classes, interfaces at runtime.

- The required classes for reflection are provided under java.lang.reflect package.
- Reflection gives us information about the class to which an object belongs and also the methods of that class which can be executed by using the object.
- Through reflection we can invoke methods at runtime irrespective of the access specifier used with them.



Reflection can be used to get information about –

1. **Class** The getClass() method is used to get the name of the class to which an object belongs.
2. **Constructors** The getConstructors() method is used to get the public constructors of the class to which an object belongs.
3. **Methods** The getMethods() method is used to get the public methods of the class to which an objects belongs.

```
// A simple Java program to demonstrate the use of reflection
import java.lang.reflect.Method;
import java.lang.reflect.Field;
import java.lang.reflect.Constructor;

// class whose object is to be created
class Test
{
    // creating a private field
    private String s;

    // creating a public constructor
    public Test()  {  s = "GeeksforGeeks"; }

    // Creating a public method with no arguments
    public void method1()  {
        System.out.println("The string is " + s);
    }

    // Creating a public method with int as argument
    public void method2(int n)  {
        System.out.println("The number is " + n);
    }

    // creating a private method
    private void method3() {
        System.out.println("Private method invoked");
    }
}

class Demo
{
    public static void main(String args[]) throws Exception
    {
        // Creating object whose property is to be checked
        Test obj = new Test();

        // Creating class object from the object using
        // getclass method
        Class cls = obj.getClass();
        System.out.println("The name of class is " +
                           cls.getName());
```

```
        // Getting the constructor of the class through the
        // object of the class
        Constructor constructor = cls.getConstructor();
        System.out.println("The name of constructor is " +
                           constructor.getName());

        System.out.println("The public methods of class are : ");

        // Getting methods of the class through the object
        // of the class by using getMethods
        Method[] methods = cls.getMethods();

        // Printing method names
        for (Method method:methods)
            System.out.println(method.getName());

        // creates object of desired method by providing the
        // method name and parameter class as arguments to
        // the getDeclaredMethod
        Method methodcall1 = cls.getDeclaredMethod("method2",
                                                   int.class);

        // invokes the method at runtime
        methodcall1.invoke(obj, 19);

        // creates object of the desired field by providing
        // the name of field as argument to the
        // getDeclaredField method
        Field field = cls.getDeclaredField("s");

        // allows the object to access the field irrespective
        // of the access specifier used with the field
        field.setAccessible(true);

        // takes object and the new value to be assigned
        // to the field as arguments
        field.set(obj, "JAVA");

        // Creates object of desired method by providing the
        // method name as argument to the getDeclaredMethod
        Method methodcall2 = cls.getDeclaredMethod("method1");

        // invokes the method at runtime
        methodcall2.invoke(obj);

        // Creates object of the desired method by providing
        // the name of method as argument to the
        // getDeclaredMethod method
        Method methodcall3 = cls.getDeclaredMethod("method3");

        // allows the object to access the method irrespective
        // of the access specifier used with the method
        methodcall3.setAccessible(true);

        // invokes the method at runtime
        methodcall3.invoke(obj);
    }
}
```

Output :


```
The name of class is Test
The name of constructor is Test
The public methods of class are :
method2
method1
wait
wait
wait
equals
toString
```

```
hashCode
getClass
notify
notifyAll
The number is 19
The string is JAVA
Private method invoked
```

Important observations :

1. We can invoke an method through reflection if we know its name and parameter types. We use below two methods for this purpose
   getDeclaredMethod() : To create an object of method to be invoked. The syntax for this method is

   ```
   Class.getDeclaredMethod(name, parametertype)
   name- the name of method whose object is to be created
   parametertype - parameter is an array of Class objects
   ```

   invoke() : To invoke a method of the class at runtime we use following method–

   ```
   Method.invoke(Object, parameter)
   If the method of the class doesn’t accepts any
   parameter then null is passed as argument.
   ```

2. Through reflection we can **access the private variables and methods** of a class with the help of its class object and invoke the method by using the object as discussed above. We use below two methods for this purpose.
   Class.getDeclaredField(FieldName) : Used to get the private field. Returns an object of type Field for specified field name.
   Field.setAccessible(true) : Allows to access the field irrespective of the access modifier used with the field.

Advantages of Using Reflection:

- **Extensibility Features:** An application may make use of external, user-defined classes by creating instances of extensibility objects using their fully-qualified names.
- **Debugging and testing tools**: Debuggers use the property of reflection to examine private members on classes.

Drawbacks:

- **Performance Overhead:** Reflective operations have slower performance than their non-reflective counterparts, and should be avoided in sections of code which are called frequently in performance-sensitive applications.
- **Exposure of Internals:** Reflective code breaks abstractions and therefore may change behavior with upgrades of the platform.

Reference:
https://docs.oracle.com/javase/tutorial/reflect/index.html

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