Dynamic Method Dispatch

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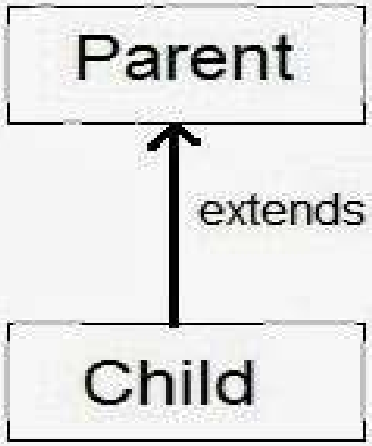
- Dynamic method dispatch is the mechanism by which a call to an overridden method is resolved at run time, rather than compile time.

- This is how Java implements run-time polymorphism.

- It is the type of the object being referred to (not the type of the reference variable) that determines which version of an overridden method will be executed.




```
Parent p = new Parent( );

Child c = new Child( );

Parent p = new Child( );
```

Upcasting

```
Child c = new Parent( );
```

incompatible type

```
class Figure {
  double dim1;
  double dim2;

  Figure(double a, double b) {
    dim1 = a;
    dim2 = b;
  }

  double area() {
    System.out.println("Area for Figure is undefined.");
    return 0;
  }
}
```

```
class Rectangle extends Figure {
  Rectangle(double a, double b) {
    super(a, b);
  }

  // override area for rectangle
  double area() {
    System.out.println("Inside Area for Rectangle.");
    return dim1 * dim2;
  }
}
```

```
class Triangle extends Figure {
   Triangle(double a, double b) {
     super(a, b);
   }

   // override area for right triangle
   double area() {
     System.out.println("Inside Area for Triangle.");
     return dim1 * dim2 / 2;
   }
}
```

```
class FindAreas {
  public static void main(String args[]) {
    Figure f = new Figure(10, 10);
    Rectangle r = new Rectangle(9, 5);
    Triangle t = new Triangle(10, 8);

    Figure figref;

    figref = r;
    System.out.println("Area is " + figref.area());

    figref = t;
    System.out.println("Area is " + figref.area());

    figref = f;
    System.out.println("Area is " + figref.area());
  }
}
```

```
class A
{
void callme()
{
System.out.println("Inside A's callme method");
}
}
class B extends A
{
void callme()   // override callme()
{
System.out.println("Inside B's callme method");
}
}
class C extends A
{
 void callme()  // override callme()
{
 System.out.println("Inside C's callme method");
}
}
```

```
public class Dynamic_disp
{
public static void main(String args[])
{
 A a = new A(); / / object of type A
 B b = new B(); / / object of type B
C c = new C(); / / object of type C
A r; / / obtain a reference of type A
r = a; / / r refers to an A object
r.callme(); / / calls A's version of callme
r = b; / / r refers to a B object
r.callme(); / / calls B's version of callme
r = c; / / r refers to a C object
r.callme(); / / calls C's version of callme
}
}
```

```
Inside A's callme method
Inside B's callme method
Inside C's callme method
```

- Here reference of type A, called r, is declared.
- The program then assigns a reference to each type of object to r and uses that reference to invoke callme( ).
- As the output shows, the version of callme( ) executed is determined by the type of object being referred to at the time of the call.

ABSTRACT CLASS

- If a class contain any abstract method then the class is declared as abstract class.
- An abstract class is never instantiated. It is used to provide abstraction. Although it does not provide 100% abstraction because it can also have concrete method.

Syntax:

```
abstract class class_name { }
```

- Abstract classes are not Interfaces. They are different, we will study this when we will study Interfaces.
- An abstract class must have an abstract method.
- Abstract classes can have Constructors, Member variables and Normal methods.
- Abstract classes are never instantiated.
- When you extend Abstract class with abstract method, you must define the abstract method in the child class, or make the child class abstract.

ABSTRACT METHOD

- Method that are declared without any body within an abstract class is known as abstract method.
- The method body will be defined by its subclass.
- Abstract method can never be final and static.
- Any class that extends an abstract class must implement all the abstract methods declared by the super class.

Syntax:

```
abstract return_type function_name (); // No definition
```

Example

```
abstract class A {
abstract void callme();
}
class B extends A {
void callme() {
System.out.println("this is callme.");
}
public static void main(String[] args) {
B b=new B(); b.callme();
}
}
```

output: this is callme.

Abstract class with concrete(normal) method

```
abstract class A {
abstract void callme();
public void normal() {
System.out.println("this is concrete method");
} }
class B extends A {
void callme() {
System.out.println("this is callme.");
}
public static void main(String[] args) {
B b=new B(); b.callme(); b.normal();
}
}
```

output: this is callme. this is concrete method.

Abstraction using abstract class

- Abstraction is an important feature of OOPS.
- It means hiding complexity.
- Abstract class is used to provide abstraction. Although it does not provide 100% abstraction because it can also have concrete method. Lets see how abstract class is used to provide abstraction.

```
abstract class Vehicle {
public abstract void engine();
 }
public class Car extends Vehicle {
public void engine() {
System.out.println("Car engine"); //car engine implementation
}
public static void main(String[] args) {
Vehicle v = new Car();
 v.engine();
}
}
```

Output: Car engine

- Here by casting instance of **Car** type to **Vehicle** reference, we are hiding the complexity of **Car** type under **Vechicle**.
- Now the **Vehicle** reference can be used to provide the implementation but it will hide the actual implementation process.

When to use Abstract Methods & Abstract Class?

- Abstract methods are usually declared where two or more subclasses are expected to do a similar thing in different ways through different implementations.
- These subclasses extend the same Abstract class and provide different implementations for the abstract methods.
- Abstract classes are used to define generic types of behaviors at the top of an object-oriented programming class hierarchy, and use its subclasses to provide implementation details of the abstract class.

```
abstract class Shape{
abstract void draw();
}
//In real scenario, implementation is provided by others i.e. unknown by end user
class Rectangle extends Shape{
void draw(){System.out.println("drawing rectangle");}
}
class Circle1 extends Shape{
void draw(){System.out.println("drawing circle");}
}
//In real scenario, method is called by programmer or user
class TestAbstraction1{
public static void main(String args[]){
Shape s=new Circle1();//In real scenario, object is provided through method e.g. getS
hape() method
s.draw();
}
}
```

Output: drawing circle

Thank you