Object Oriented Programming in Java

Records

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Records in Java

Using Record to Model Immutable Data

The Java language gives you several ways to create an immutable class. Probably the most straightforward way is to create a final class with final fields and a constructor to initialize these fields.

Records in Java

example of an immutable data class.

```java
public class Point {
    private final int x;
    private final int y;

    public Point(int x, int y) {
        this.x = x;
        this.y = y;
    }
}
```

Records in Java

Problem with Traditional Approach

- You need to add the accessors for your fields.
- Add a `toString()` method.
- Add `equals()` along with an `hashCode()` method.
- Consider making this class serializable if you need to send the data of this class over network or through a file system.

In the end, your `Point` class may be a hundred lines long, mostly populated with code generated by your IDE.

Records in Java

Records have been added to the JDK to change this. Starting with Java SE 14:

```java
public record Point(int x, int y) {}
```

This single line of code creates:

- An immutable class with two fields: x and y
- A canonical constructor
- toString(), equals() and hashCode() methods
- Can implement Serializable

The Class of a Record

A record is class declared with the `record` keyword instead of `class`.

```java
public record Point(int x, int y) {}
```

Key characteristics:

- The class is final
- Extends `java.lang.Record`
- Cannot extend any other class
- Can implement any number of interfaces

Declaring Record Components

The block that immediately follows the name of the record declares its components.

```
public record Point(int x, int y) {}
```

For each component:

- Private final field is created
- Accessor method is generated (e.g., x())
- Default toString(), equals() and hashCode() are created

Restrictions on Records

Things you cannot add to a record:

1. Cannot declare any instance field not corresponding to a component
2. Cannot define any field initializer
3. Cannot add any instance initializer

You can:

- Create static fields with initializers
- Add static initializers

Constructing a Record

The compiler creates a canonical constructor that takes the components as arguments.
Two ways to customize it:

1. Compact constructor (doesn't declare parameters)
2. Regular canonical constructor

Constructing a Record

Example of compact constructor:

```java
public record Range(int start, int end) {
    public Range {
        if (end <= start) throw new IllegalArgumentException(...);
    }
}
```

Constructing a Record

Defining Additional Constructors: (that calls the canonical one)

```
public record State(String name, String capitalCity, List<String> cities) {
  public State(String name, String capitalCity) {
    this(name, capitalCity, List.of());
  }

  public State(String name, String capitalCity, String... cities) {
    this(name, capitalCity, List.of(cities));
  }
}
```

Accessor Methods

Records automatically generate accessor methods named after components.

▓ Example for Point:

```
public int x() { return this.x; }
public int y() { return this.y; }
```

You can override them if needed, for example to return defensive copies.

Serializing Records

Records can be serialized if they implement `Serializable`:

- Cannot customize serialization process (no `writeObject/readObject`)
- Deserialization always calls the canonical constructor
- Can use `readResolve()` and `writeReplace()`

This makes records excellent for data transport objects.