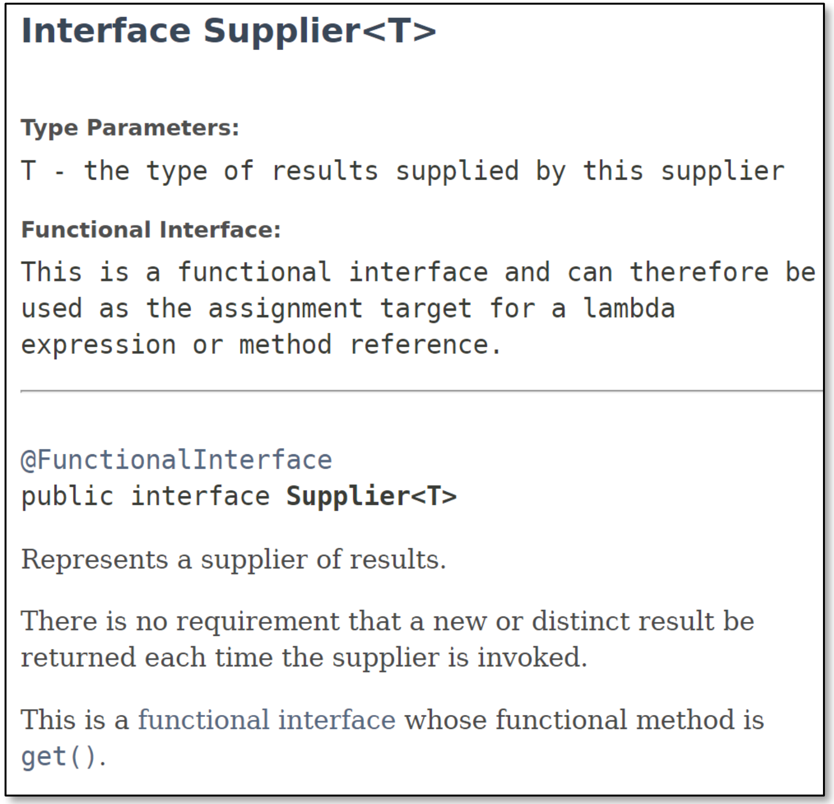
Java 8 Functional Interfaces

Supplier

Douglas C. Schmidt

Learning Objectives in This Lesson

- Recognize foundational functional programming features in Java 8, e.g.,
  - Lambda expressions
  - Method & constructor references
  - Key functional interfaces
    - Predicate
    - Function
    - BiFunction
    - Supplier



Interface Supplier<T>

Type Parameters:

`T - the type of results supplied by this supplier`

Functional Interface:

`This is a functional interface and can therefore be used as the assignment target for a lambda expression or method reference.`

```
@FunctionalInterface
public interface Supplier<T>
```

Represents a supplier of results.

There is no requirement that a new or distinct result be returned each time the supplier is invoked.

This is a functional interface whose functional method is `get()`.

Douglas C. Schmidt

Overview of Functional Interfaces: Supplier

Overview of Common Functional Interfaces: Supplier

- A *Supplier* returns a value & takes no parameters, e.g.,
  - `public interface Supplier<T> { T get(); }`

See docs.oracle.com/javase/8/docs/api/java/util/function/Supplier.html

Overview of Common Functional Interfaces: Supplier

- A *Supplier* returns a value & takes no parameters, e.g.,
  - `public interface Supplier<T> { T get(); }`

Supplier is a generic interface that is parameterized by one reference type

See docs.oracle.com/javase/8/docs/api/java/util/function/Supplier.html

Overview of Common Functional Interfaces: Supplier

- A *Supplier* returns a value & takes no parameters, e.g.,
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Its single abstract method is passed no parameters & returns a value of type T.

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Overview of Common Functional Interfaces: Supplier

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  - `public interface Supplier<T> { T get(); }`

```
Map<String, String> beingMap = new HashMap<String, String>()
{ { put("Demon", "Naughty"); put("Angel", "Nice"); } };

String being = ...;

Optional<String> disposition =
  Optional.ofNullable(beingMap.get(being));

System.out.println("disposition of "
                   + being + " = "
                   + disposition.orElseGet(() -> "unknown"));
```

See github.com/douglascraigschmidt/LiveLessons/tree/master/Java8/ex6

Overview of Common Functional Interfaces: Supplier

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```

Create a hash map that associates beings with their personality traits.

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System.out.println("disposition of "
                   + being + " = "
                   + disposition.orElseGet(() -> "unknown"));
```

Get the name of a being from somewhere (e.g., prompt user)

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System.out.println("disposition of "
                   + being + " = "
                   + disposition.orElseGet(() -> "unknown"));
```

Return an optional describing the specified being if non-null, otherwise return an empty Optional

See docs.oracle.com/javase/8/docs/api/java/util/Optional.html#ofNullable

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System.out.println("disposition of "
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                   + disposition.orElseGet(() -> "unknown"));
```

A container object which may or may not contain a non-null value

See docs.oracle.com/javase/8/docs/api/java/util/Optional.html

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Optional<String> disposition =
  Optional.ofNullable(beingMap.get(being));

System.out.println("disposition of "
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                   + disposition.orElseGet(() -> "unknown"));
```

Returns value if being is non-null

See docs.oracle.com/javase/8/docs/api/java/util/Optional.html#orElseGet

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Map<String, String> beingMap = new HashMap<String, String>()
{ { put("Demon", "Naughty"); put("Angel", "Nice"); } };

String being = ...;

Optional<String> disposition =
  Optional.ofNullable(beingMap.get(being));

System.out.println("disposition of "
                   + being + " = "
                   + disposition.orElseGet(() -> "unknown"));
```

Returns supplier lambda value if being is not found

Overview of Common Functional Interfaces: Supplier

- A *Supplier* returns a value & takes no parameters, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class Optional<T> {
  ...
  public T orElseGet(Supplier<? extends T> other) {
    return value != null
      ? value
      : other.get();
  }
```

Here's how the orElseGet() method uses the Supplier passed to it.

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```
class Optional<T> {
  ...
  public T orElseGet(Supplier<? extends T> other) {
    return value != null
      ? value
      : other.get();
  }
```

```
() -> "unknown"
```

The string literal "unknown" is bound to the supplier lambda parameter.

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```
class Optional<T> {
  ...
  public T orElseGet(Supplier<? extends T> other) {
    return value != null
      ? value
      : other.get();
  }
```

`() -> "unknown"`

`"unknown"`

The string "unknown" returns by orElseGet() if the value is null.

Overview of Common Functional Interfaces: Supplier

- A *Supplier* can also be used for a zero-param constructor reference, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  String mString;

  void zeroParamConstructorRef() {
    Supplier<CrDemo> factory = CrDemo::new;
    CrDemo crDemo = factory.get();
    crDemo.run();
  }

  @Override
  void run() { System.out.println(mString); }
  ...
}
```

See github.com/douglascraigschmidt/LiveLessons/tree/master/Java8/ex7

Overview of Common Functional Interfaces: Supplier

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class CrDemo implements Runnable {
  String mString;

  void zeroParamConstructorRef() {
    Supplier<CrDemo> factory = CrDemo::new;
    CrDemo crDemo = factory.get();
    crDemo.run();
  }

  @Override
  void run() { System.out.println(mString); }
  ...
}
```

Create a supplier that's initialized with a zero -param constructor reference for CrDemo

See www.speakingcs.com/2014/08/constructor-references-in-java-8.html

Overview of Common Functional Interfaces: Supplier

- A *Supplier* can also be used for a zero-param constructor reference, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  String mString;

  void zeroParamConstructorRef() {
    Supplier<CrDemo> factory = CrDemo::new;
    CrDemo crDemo = factory.get();
    crDemo.run();
  }

  @Override
  void run() { System.out.println(mString); }
  ...
}
```

get() creates a CrDemo object using a constructor reference for the CrDemo "default" constructor.

Overview of Common Functional Interfaces: Supplier

- A *Supplier* can also be used for a zero-param constructor reference, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  String mString;

  void zeroParamConstructorRef() {
    Supplier<CrDemo> factory = CrDemo::new;
    CrDemo crDemo = factory.get();
    crDemo.run();
  }

  @Override
  void run() { System.out.println(mString); }
  ...
}
```

Call a method in CrDemo to print the result

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  static class CrDemoEx
         extends CrDemo {

    @Override
    public void run() {
      System.out.println(mString.toUpperCase());
    }
  }
  ...
```

This class extends CrDemo & overrides its run() method to uppercase the string.

See www.javabrahman.com/java-8/constructor-references-java-8-simplified-tutorial

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  static class CrDemoEx
         extends CrDemo {

    @Override
    public void run() {
      System.out.println(mString.toUpperCase());
    }
  }
  ...
```

Print the uppercased value of mString

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  void zeroParamConstructorRefEx() {

    Supplier<CrDemo> crDemoFactory = CrDemo::new;
    Supplier<CrDemoEx> crDemoFactoryEx = CrDemoEx::new;

    runDemo(crDemoFactory);
    runDemo(crDemoFactoryEx);
  }
  ...
```

Demonstrate how suppliers can be used as factories for multiple zero-param constructor references

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  void zeroParamConstructorRefEx() {

    Supplier<CrDemo> crDemoFactory = CrDemo::new;
    Supplier<CrDemoEx> crDemoFactoryEx = CrDemoEx::new;

    runDemo(crDemoFactory);
    runDemo(crDemoFactoryEx);
  }
  ...
```

Assign a constructor reference to a supplier that acts as a factory for a zero-param object of CrDemo/CrDemoEx

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  void zeroParamConstructorRefEx() {




    Supplier<CrDemo> crDemoFactory = CrDemo::new;
    Supplier<CrDemoEx> crDemoFactoryEx = CrDemoEx::new;

    runDemo(crDemoFactory);
    runDemo(crDemoFactoryEx);
  }
  ...
```

This helper method invokes the given supplier to create a new object & call its run() method.

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  <T extends Runnable> void runDemo(Supplier<T> factory) {
    factory.get().run();
  }
  ...
```

Use the given factory to create a new object & call its run() method

Overview of Common Functional Interfaces: Supplier

- Constructor references simplify creation of parameterizable factory methods.
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable {
  ...
  <T extends Runnable> void runDemo(Supplier<T> factory) {
    factory.get().run();
  }
  ...
```

This call encapsulates details of the concrete constructor that's used to create an object!

Overview of Common Functional Interfaces: Supplier

- Arbitrary constructors with params can also be supported in Java 8, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable { ...
  interface TriFactory<A, B, C, R> { R of(A a, B b, C c); }
```

Custom functional interfaces can be defined for arbitrary constructors with params.

```
  void threeParamConstructorRef() {
    TriFactory<String, Integer, Long, CrDemo> factory =
      CrDemo::new;

    factory.of("The answer is ", 4, 2L).run();
  }

  CrDemo(String s, Integer i, Long l)
  { mString = s + i + l; } ...
```

This capability is unrelated to the Supplier interface.

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- Arbitrary constructors with params can also be supported in Java 8, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable { ...
  interface TriFactory<A, B, C, R> { R of(A a, B b, C c); }


  void threeParamConstructorRef() {
    TriFactory<String, Integer, Long, CrDemo> factory =
      CrDemo::new;

    factory.of("The answer is ", 4, 2L).run();
  }

  CrDemo(String s, Integer i, Long l)
  { mString = s + i + l; } ...
```

Create a factory that's initialized with a three-param constructor reference

Overview of Common Functional Interfaces: Supplier

- Arbitrary constructors with params can also be supported in Java 8, e.g.,
  - `public interface Supplier<T> { T get(); }`

```
class CrDemo implements Runnable { ...
  interface TriFactory<A, B, C, R> { R of(A a, B b, C c); }


  void threeParamConstructorRef() {
    TriFactory<String, Integer, Long, CrDemo> factory =
      CrDemo::new;

    factory.of("The answer is ", 4, 2L).run();
  }

  CrDemo(String s, Integer i, Long l)
  { mString = s + i + l; } ...
```

Create/print a three-param instance of CrDemo