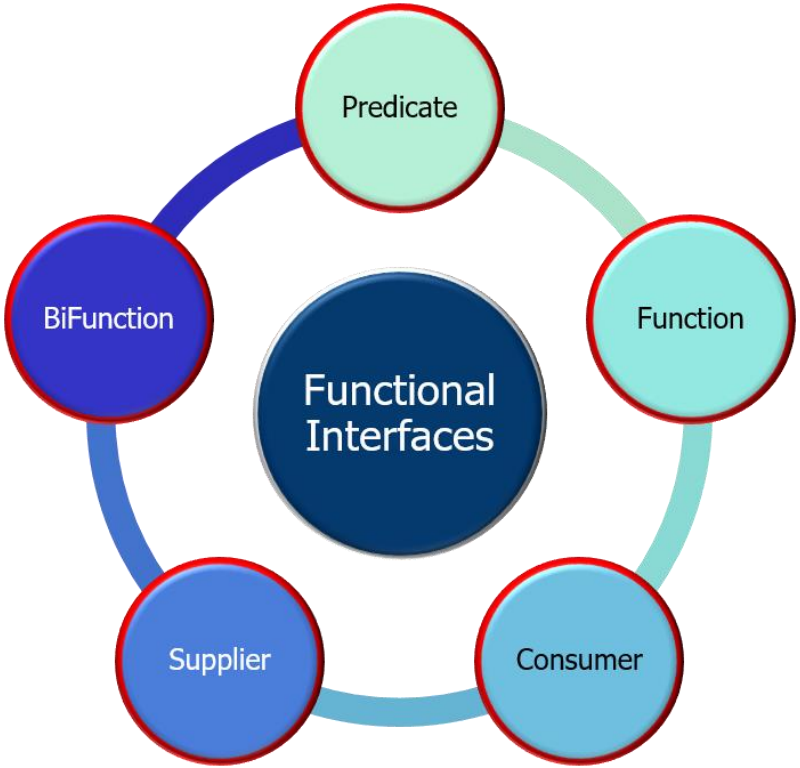
Java 8 Functional Interfaces

Introduction

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



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- Recognize foundational functional programming features in Java 8, e.g.,
  - Lambda expressions
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  - Key functional interfaces

These features are the basis for Java streams & concurrency/parallelism frameworks.

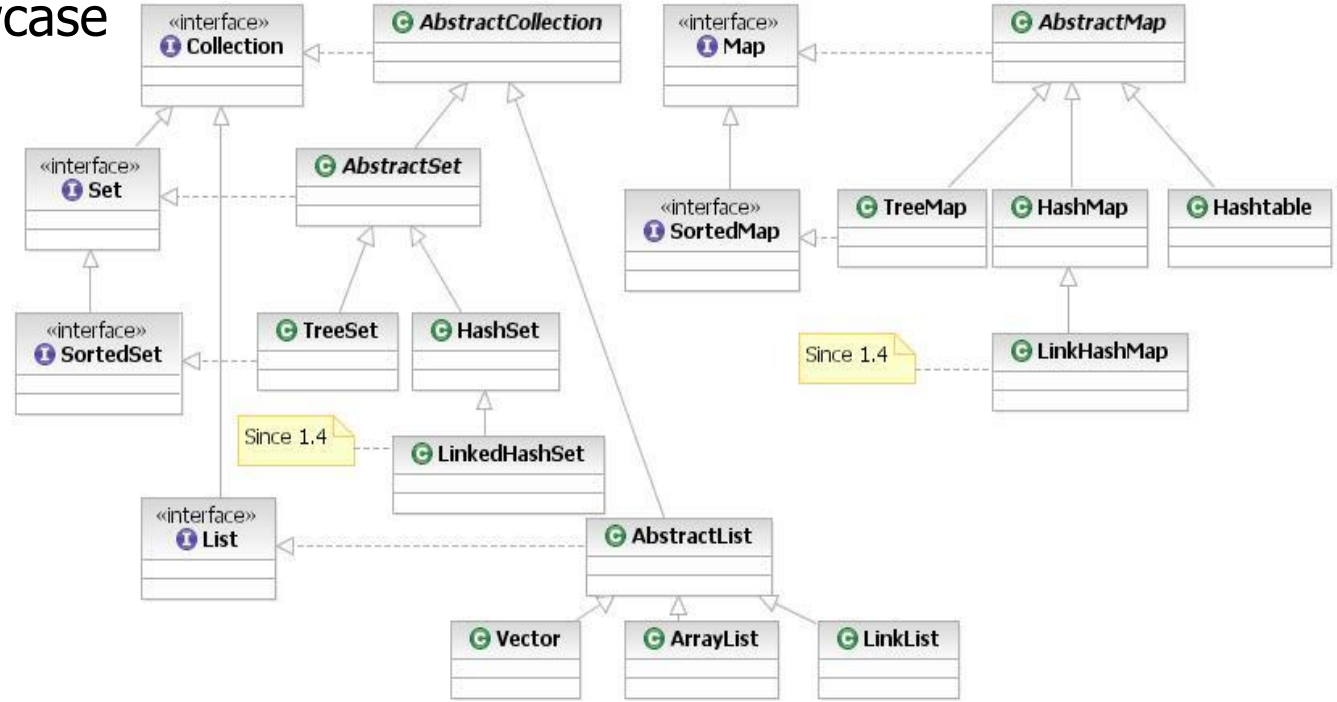
Learning Objectives in This Lesson

- Recognize foundational functional programming features in Java 8.
- Understand how to apply these Java 8 features in concise example programs.

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

Learning Objectives in This Lesson

- Recognize foundational functional programming features in Java 8.
- Understand how to apply these Java 8 features in concise example programs.
  - The examples showcase the Java collections framework.



See docs.oracle.com/javase/8/docs/technotes/guides/collections

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Overview of Common Functional Interfaces

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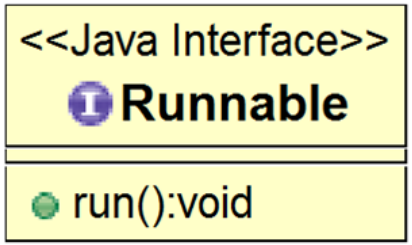
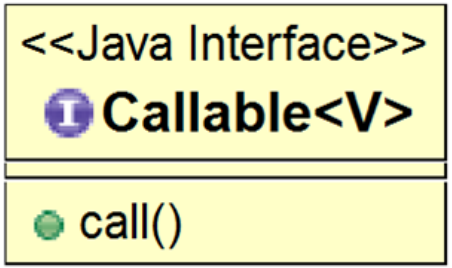
- A *functional interface* contains only one abstract method.





See www.oreilly.com/learning/java-8-functional-interfaces

Overview of Common Functional Interfaces

- A functional interface is the type used for a parameter when a lambda expression or method reference is passed as an argument to a method.

```
<T> void runTest(Function<T, T> fact, T n) {
  long startTime = System.nanoTime();
  T result = fact.apply(n));
  long stopTime = (System.nanoTime() - startTime) / 1_000_000;
  ...
}
runTest(ParallelStreamFactorial::factorial, n);
runTest(SequentialStreamFactorial::factorial, n);
...
```

See www.baeldung.com/java-8-functional-interfaces

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```

Records & prints the time taken to compute 'n' factorial.

See github.com/douglascraigschmidt/LiveLessons/tree/master/Java8/ex16

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'fact' parameterizes the factorial implementation.

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

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Different factorial implementations can be passed as parameters to runTest().

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```

```
static BigInteger factorial(BigInteger n) {
  return LongStream.rangeClosed(1, n)
                   .parallel()
                   .mapToObj(BigInteger::valueOf)
                   .reduce(BigInteger.ONE, BigInteger::multiply);
}
```

Overview of Common Functional Interfaces

- Java 8 defines many types of functional interfaces.

Package java.util.function

Functional interfaces provide target types for lambda expressions and method references.

See: Description

Interface Summary

Interface	Description
BiConsumer<T,U>	Represents an operation that accepts two input arguments and returns no result.
BiFunction<T,U,R>	Represents a function that accepts two arguments and produces a result.
BinaryOperator<T>	Represents an operation upon two operands of the same type, producing a result of the same type as the operands.
BiPredicate<T,U>	Represents a predicate (boolean-valued function) of two arguments.
BooleanSupplier	Represents a supplier of `boolean`-valued results.
Consumer<T>	Represents an operation that accepts a single input argument and returns no result.
DoubleBinaryOperator	Represents an operation upon two `double`-valued operands and producing a `double`-valued result.
DoubleConsumer	Represents an operation that accepts a single `double`-valued argument and returns no result.
DoubleFunction<R>	Represents a function that accepts a double-valued argument and produces a result.
DoublePredicate	Represents a predicate (boolean-valued function) of one `double`-valued argument.
DoubleSupplier	Represents a supplier of `double`-valued results.
DoubleToIntFunction	Represents a function that accepts a double-valued argument and produces an int-valued result.
DoubleToLongFunction	Represents a function that accepts a double-valued argument and produces a long-valued result.
DoubleUnaryOperator	Represents an operation on a single `double`-valued operand that produces a `double`-valued result.
Function<T,R>	Represents a function that accepts one argument and produces a result.

See docs.oracle.com/javase/8/docs/api/java/util/function/package-summary.html

Overview of Common Functional Interfaces

- Java 8 defines many types of functional interfaces.
  - Some of these interfaces handle reference types.

Package java.util.function

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See www.oreilly.com/library/view/java-8-pocket/9781491901083/ch04.html

Overview of Common Functional Interfaces

- Java 8 defines many types of functional interfaces.
  - Some of these interfaces handle reference types.
  - Other interfaces support primitive types.

Package java.util.function

Functional interfaces provide target types for lambda expressions and method references.

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IntConsumer	Represents an operation that accepts a single int-valued argument and returns no result.
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IntUnaryOperator	Represents an operation on a single int-valued operand that produces an int-valued result.
LongBinaryOperator	Represents an operation upon two long-valued operands and producing a long-valued result.
LongConsumer	Represents an operation that accepts a single long-valued argument and returns no result.
LongFunction<R>	Represents a function that accepts a long-valued argument and produces a result.
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ObjDoubleConsumer<T>	Represents an operation that accepts an object-valued and a double-valued argument, and returns no result.
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See docs.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html

Overview of Common Functional Interfaces

- Java 8 defines many types of functional interfaces.
  - Some of these interfaces handle reference types.
  - Other interfaces support primitive types.
    - Avoids "auto-boxing" overhead.

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See rules.sonarsource.com/java/tag/performance/RSPEC-4276

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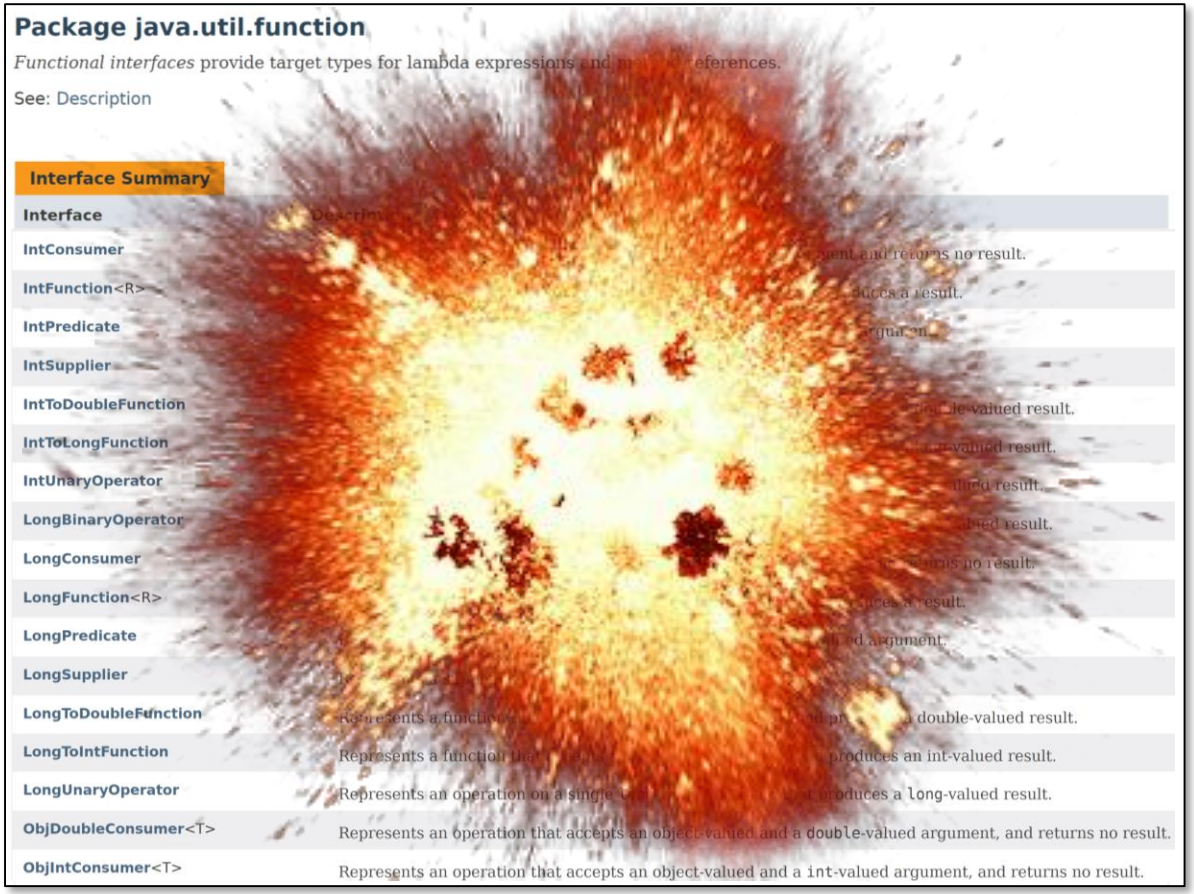
- Java 8 defines many types of functional interfaces.
  - Some of these interfaces handle reference types.
  - Other interfaces support primitive types.
- There's an explosion of Java functional interfaces!



See dzone.com/articles/whats-wrong-java-8-part-ii

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- Java 8 defines many types of functional interfaces.
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  - Other interfaces support primitive types.
- There's an explosion of Java functional interfaces!
  - However, learn these interfaces before trying to customize your own.

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See tutorials.jenkov.com/java-functional-programming/functional-interfaces.html

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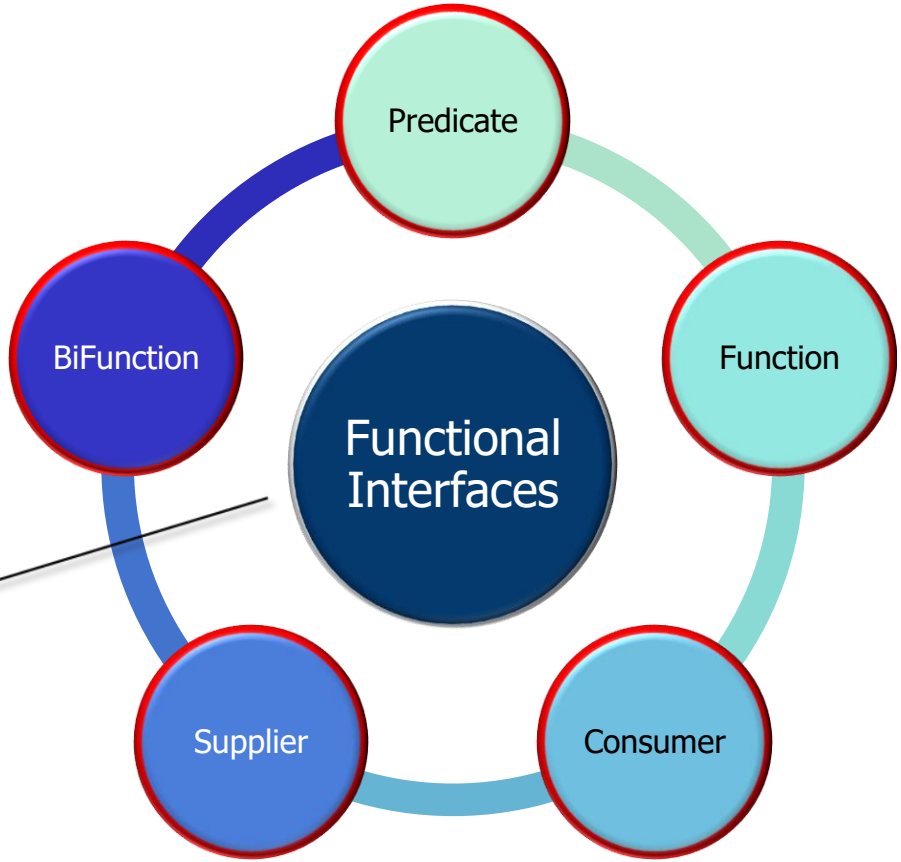
We focus on the most common types of functional interfaces.



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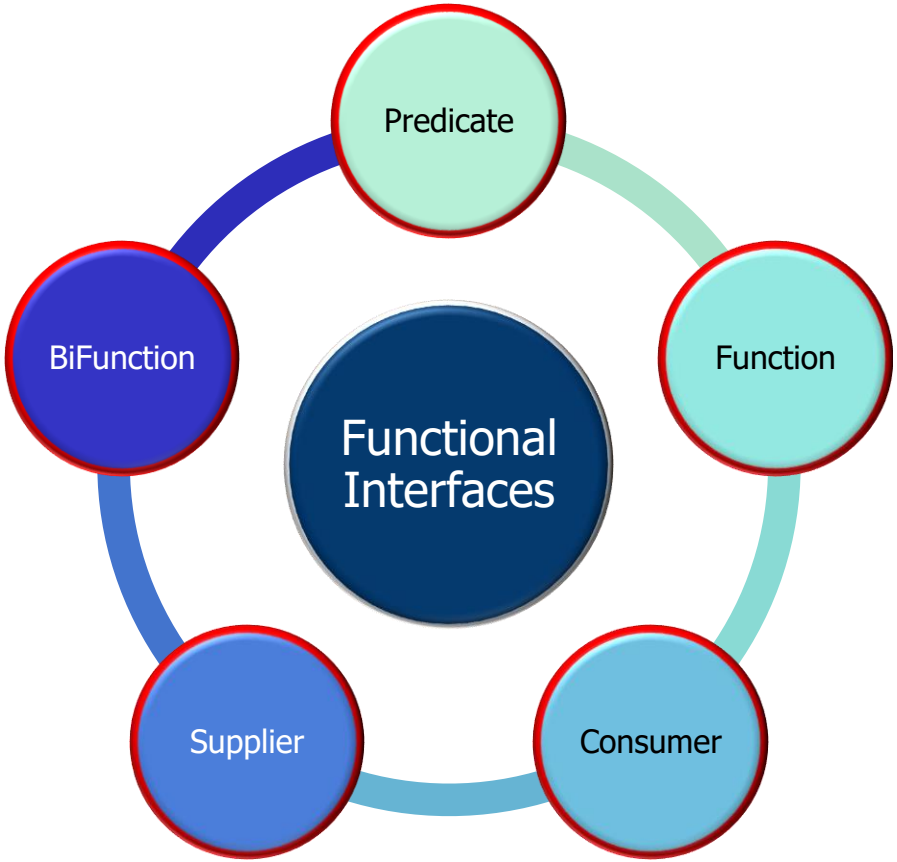

All usages of functional interfaces in the upcoming examples are "stateless"!