Java Functional Interfaces: Overview

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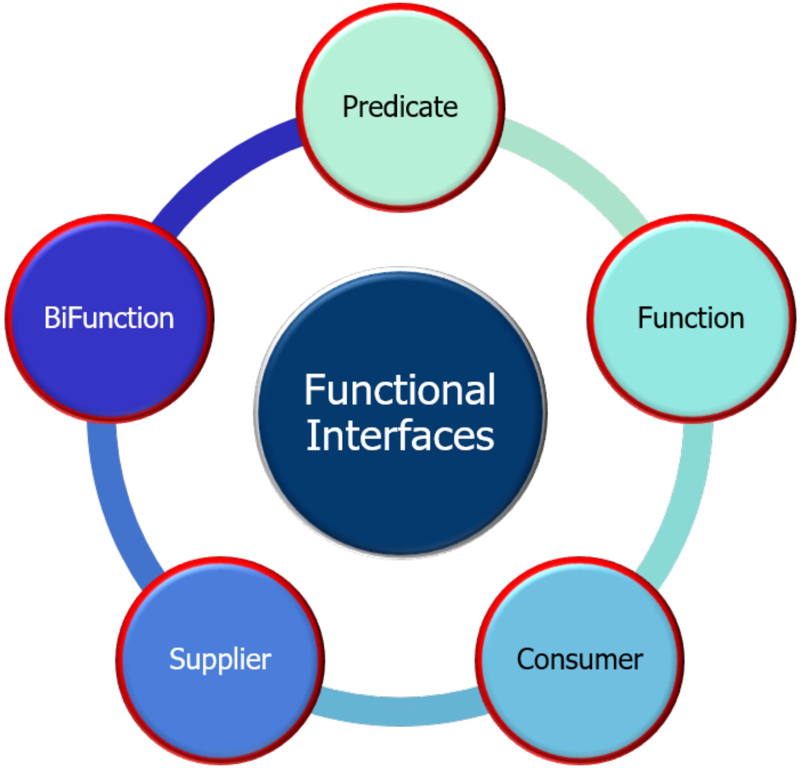
Learning Objectives in this Part of the Lesson

- Understand what functional interfaces are in modern Java & how they can be used in conjunction with lambda expressions & method references



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- Understand what functional interfaces are in modern Java & how they can be used in conjunction with lambda expressions & method references

These features form the basis for Java Streams & concurrency/parallelism frameworks

Overview of Functional Interfaces

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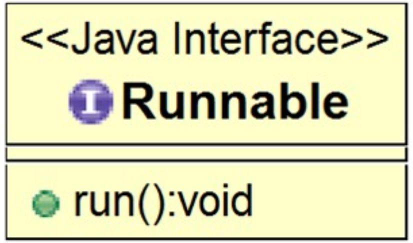
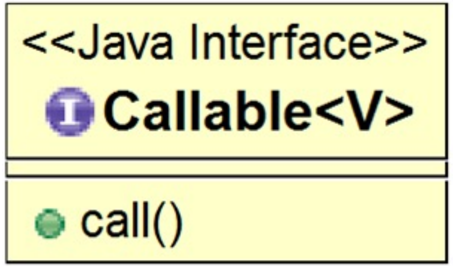
- A *functional interface* is an interface containing one abstract method





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

Overview of Functional Interfaces

- A functional interface is the type used for a param when a lambda expression or method reference is passed 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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A useful reusable helper method

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

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Record & print time taken to compute 'n' factorial

$$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$$

See en.wikipedia.org/wiki/Factorial

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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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  ...
}
runTest(ParallelStreamFactorial::factorial, n);
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```

Different factorial implementations can be passed as method reference params to the runTest() method

This is an example of behavior parameterization

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

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

Summary of Common Functional Interfaces

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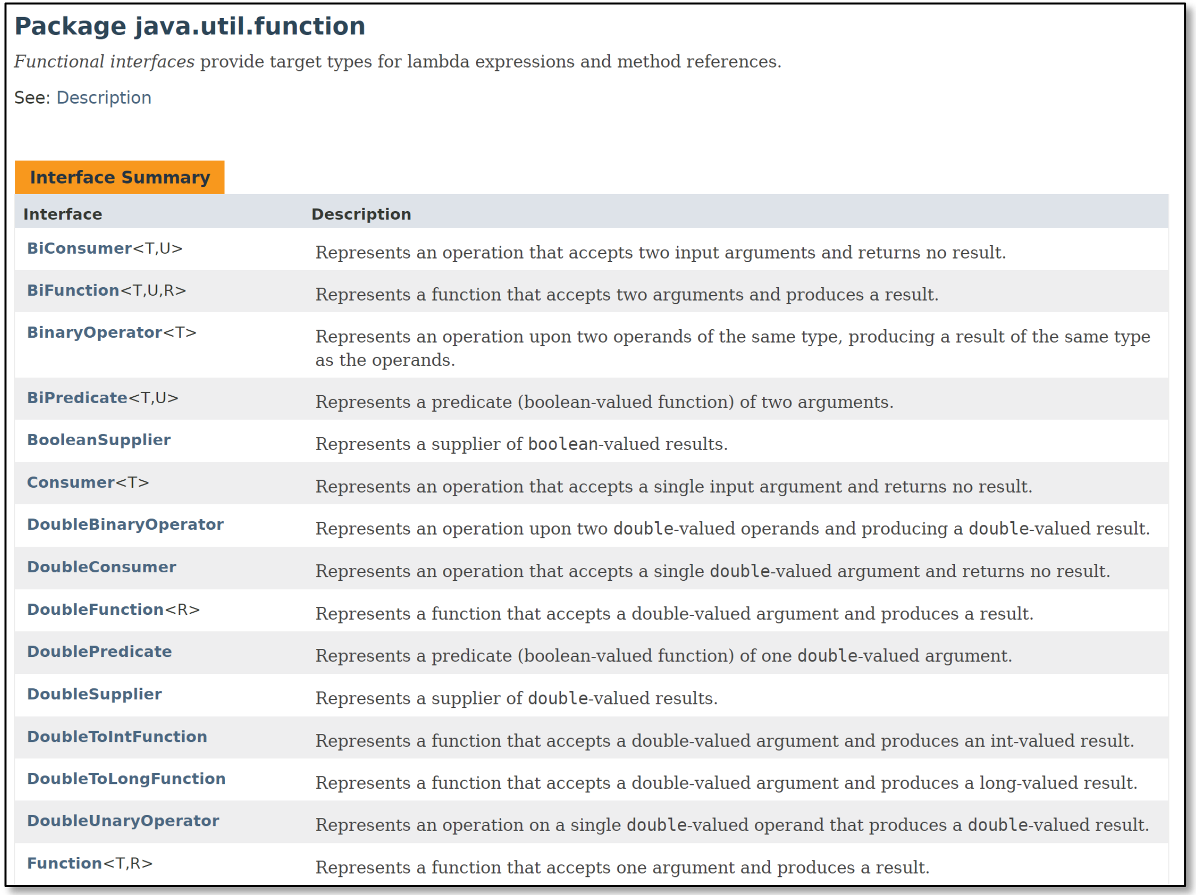
- Java defines many types of functional interfaces



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.
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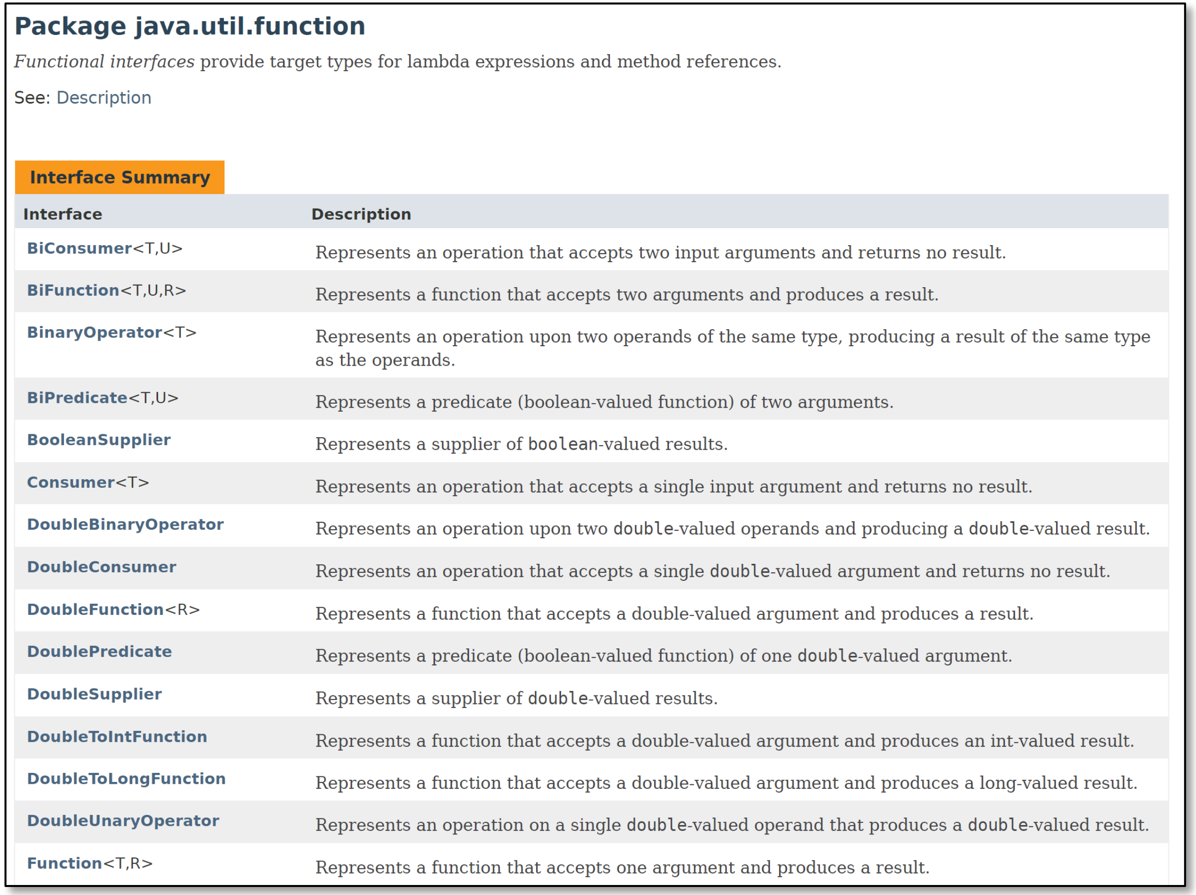
Function<T,R>	Represents a function that accepts one argument and produces a result.

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

Summary of Common Functional Interfaces

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



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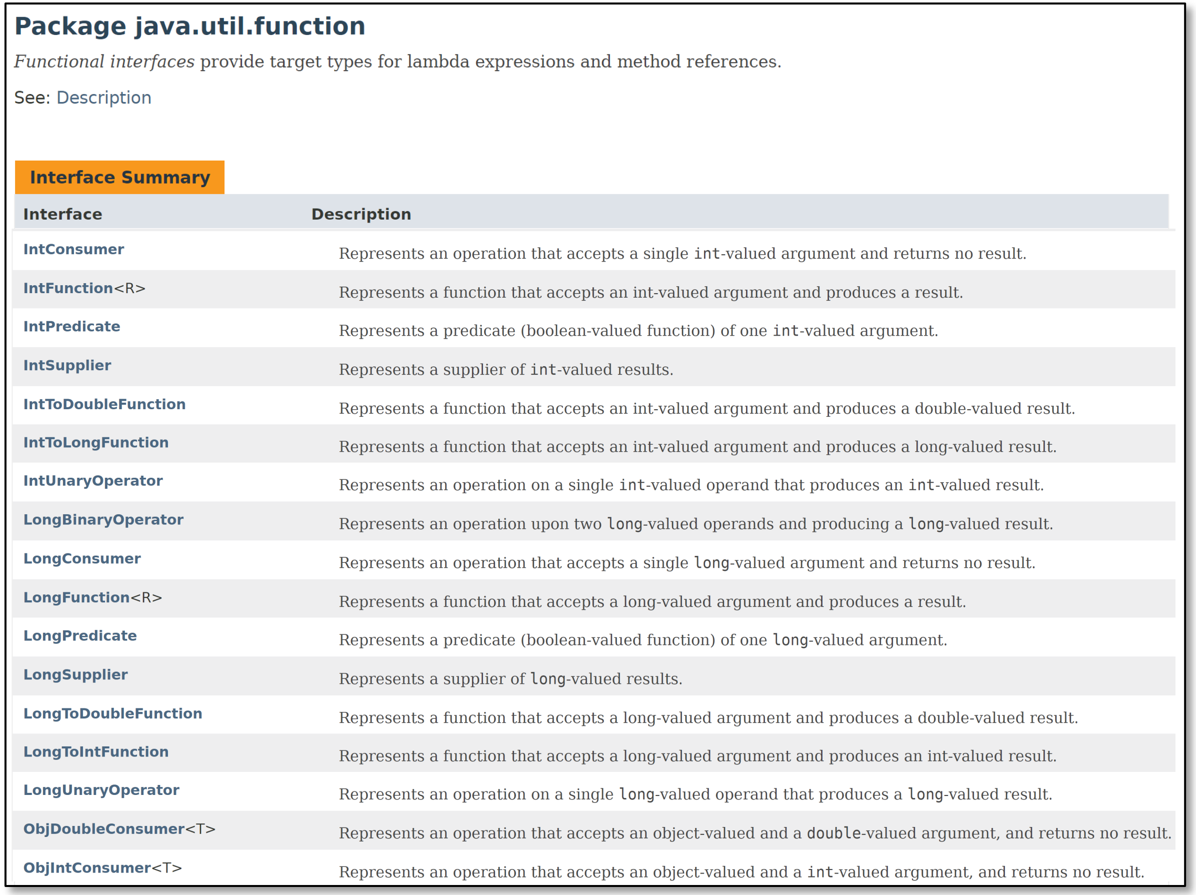
See www.oreilly.com/library/view/java-8-pocket/9781491901083/ch04.html

Summary of Common Functional Interfaces

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



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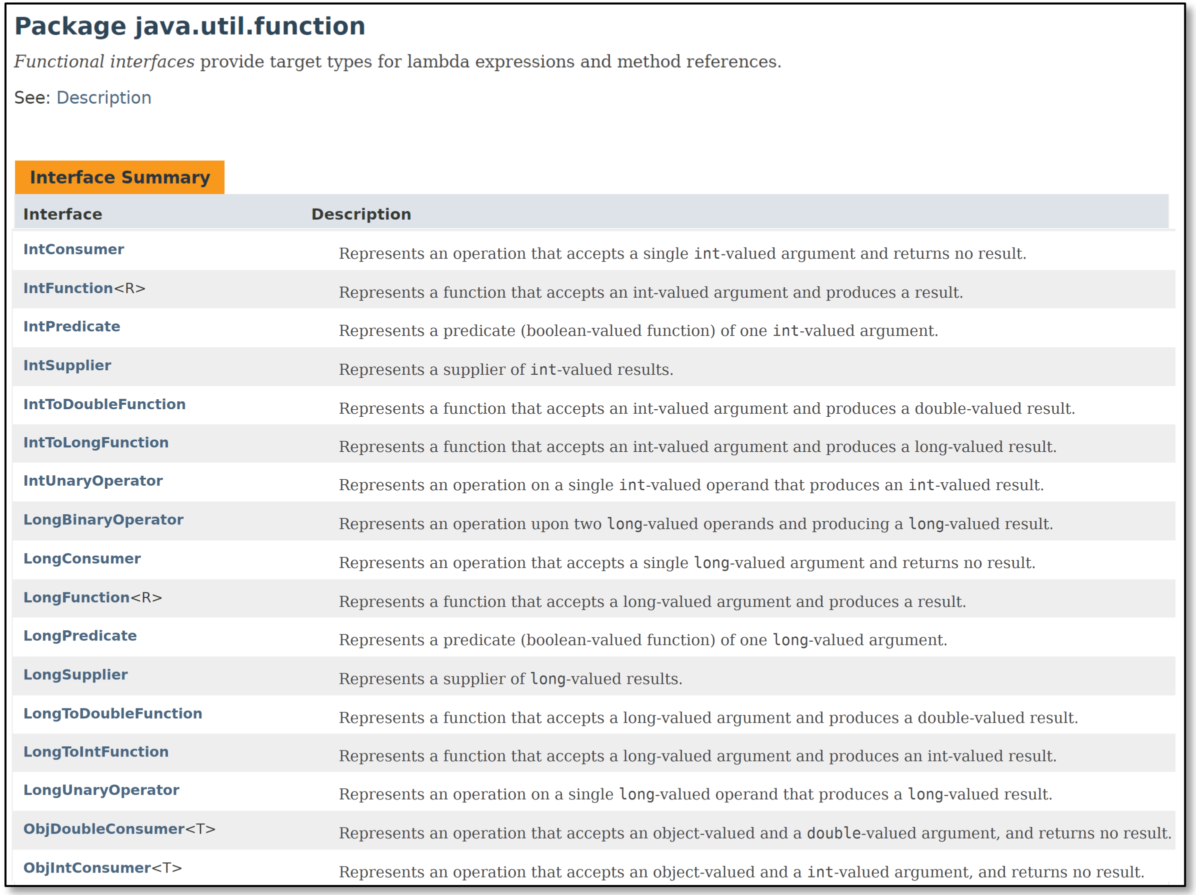
See docs.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html

Summary of Common Functional Interfaces

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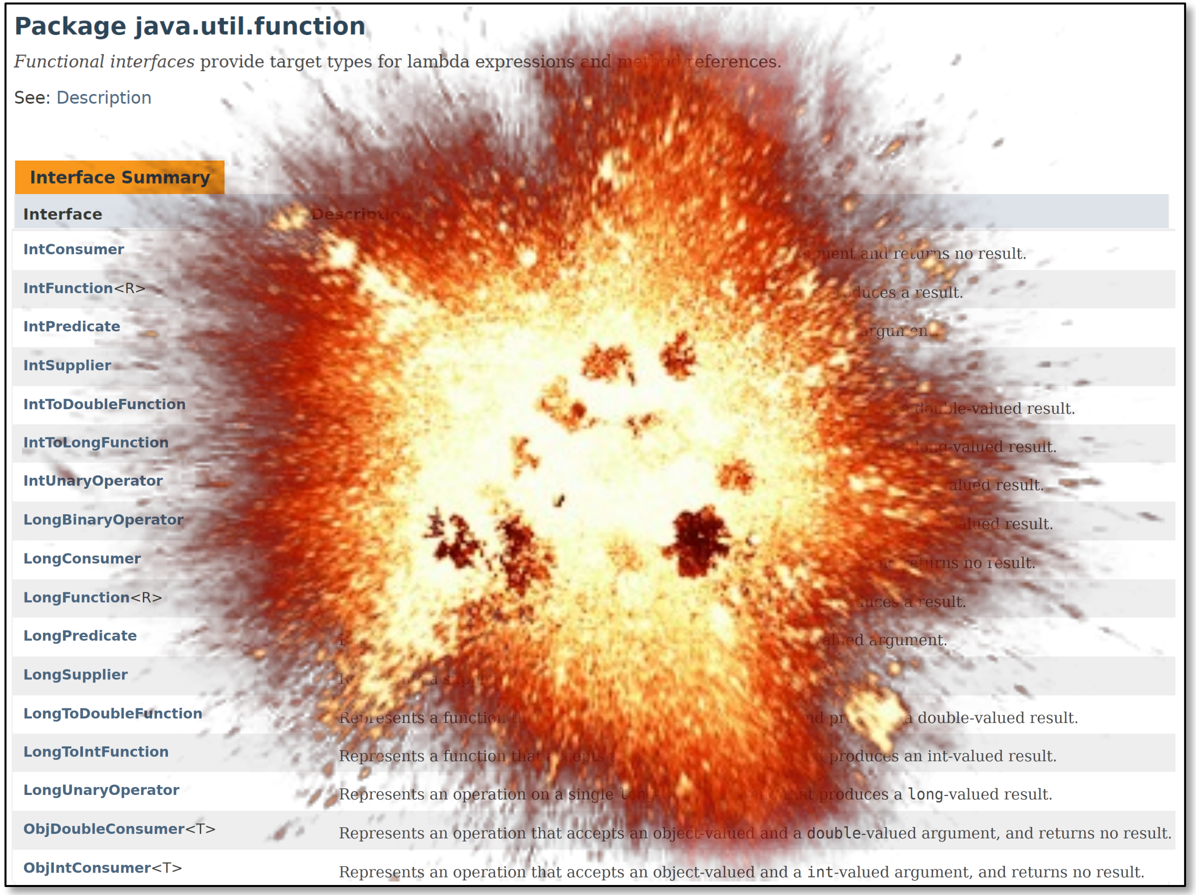
See rules.sonarsource.com/java/tag/performance/RSPEC-4276

Summary of Common Functional Interfaces

- Java 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!



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IntPredicate	[illegible] argument.
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See dzone.com/articles/whats-wrong-java-8-part-ii

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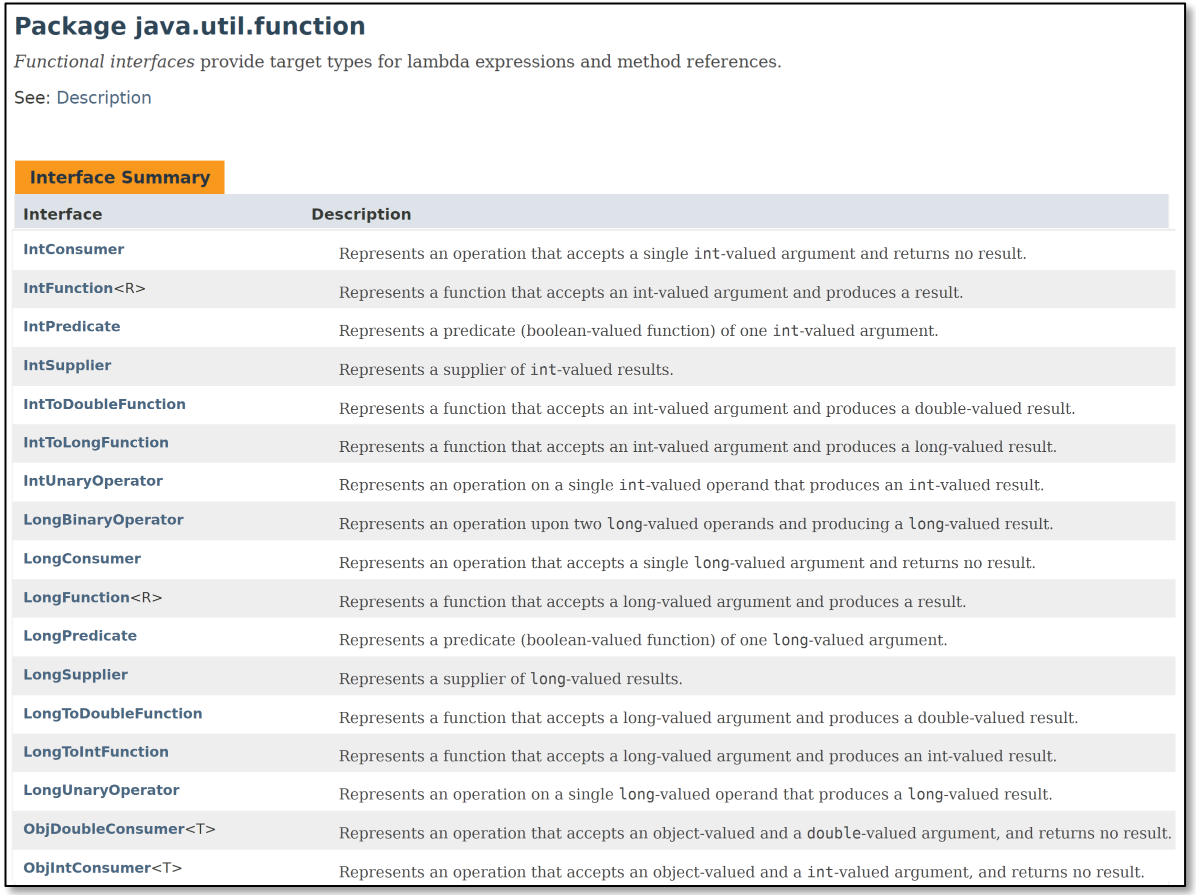
- Java defines many types of functional interfaces
  - Some of these interfaces handle reference types
  - Other interfaces support primitive types.
  - There's an explosion of Java functional interfaces!
    - However, learn these interfaces before trying to customize your own



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

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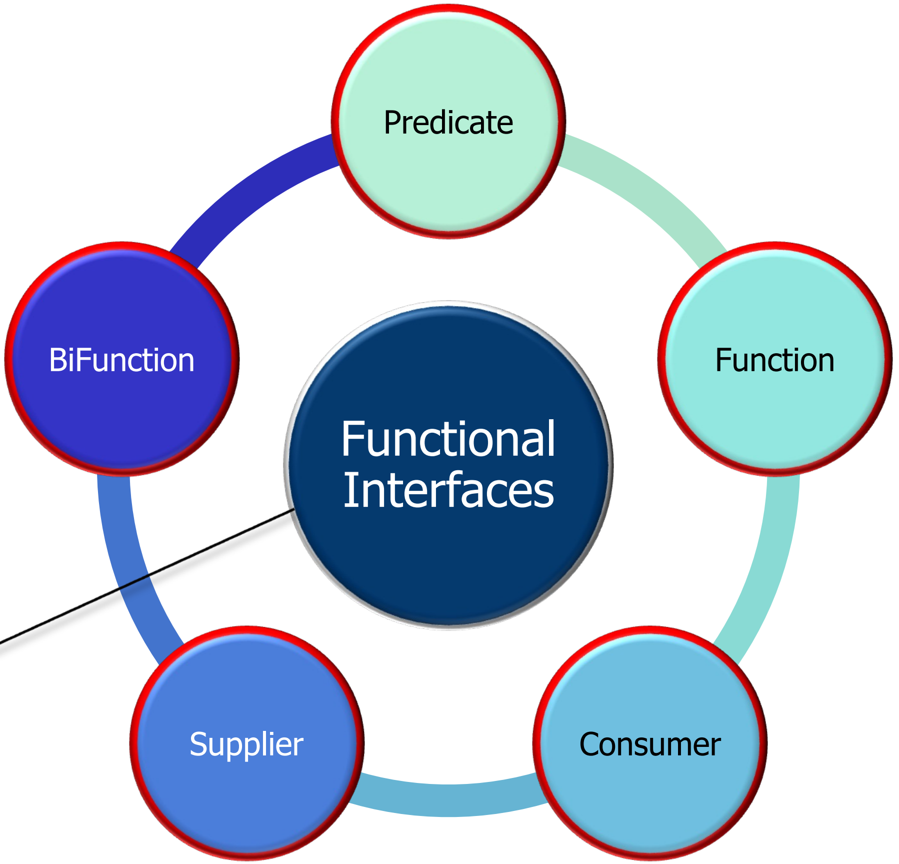
We focus on the most common types of functional interfaces



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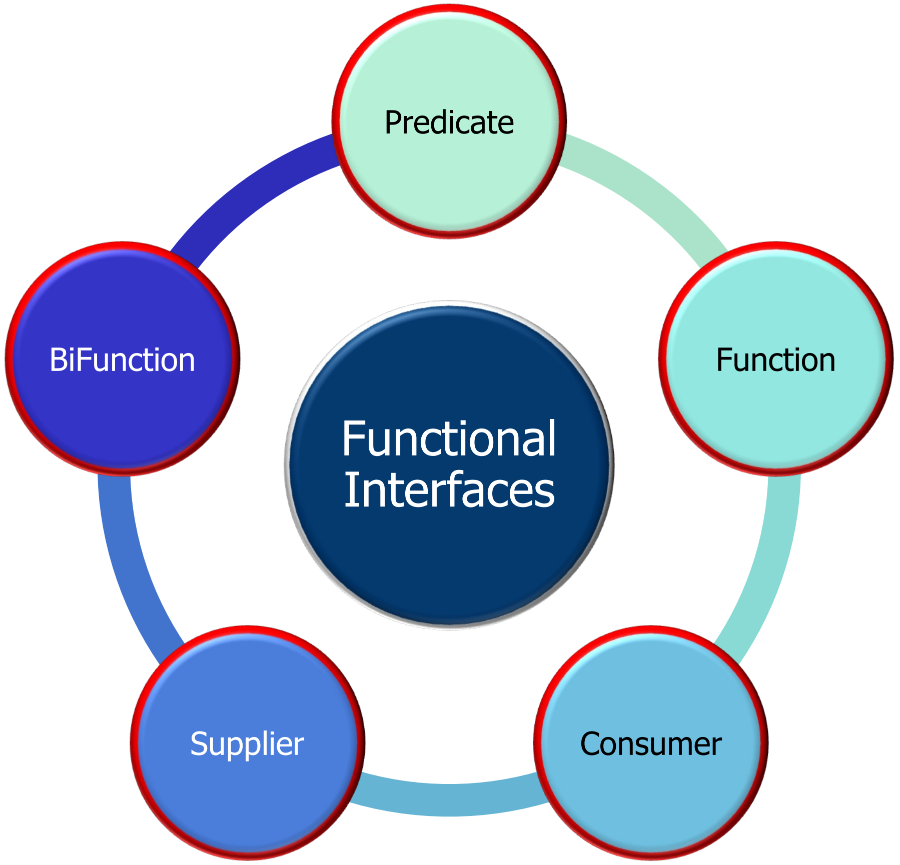

All usages of functional interfaces in the upcoming examples are "stateless"!

End of Java Functional Interfaces: Overview