# What's New in JDK 8

Java Platform, Standard Edition 8 is a major feature release. This document summarizes features and enhancements in Java SE 8 and in JDK 8, Oracle's implementation of Java SE 8. Click the component name for a more detailed description of the enhancements for that component.

## Java Programming Language

Lambda Expressions, a new language feature, has been introduced in this release. They enable you to treat functionality as a method argument, or code as data. Lambda expressions let you express instances of single-method interfaces (referred to as functional interfaces) more compactly.

Method references provide easy-to-read lambda expressions for methods that already have a name.

Default methods enable new functionality to be added to the interfaces of libraries and ensure binary compatibility with code written for older versions of those interfaces.

Repeating Annotations provide the ability to apply the same annotation type more than once to the same declaration or type use.

Type Annotations provide the ability to apply an annotation anywhere a type is used, not just on a declaration. Used with a pluggable type system, this feature enables improved type checking of your code.

Improved type inference.

Method parameter reflection.

## Collections

Classes in the new `java.util.stream` package provide a Stream API to support functional-style operations on streams of elements. The Stream API is integrated into the Collections API, which enables bulk operations on collections, such as sequential or parallel map-reduce transformations.

Performance Improvement for HashMaps with Key Collisions

## Compact Profiles

Compact Profiles contain predefined subsets of the Java SE platform and enable applications that do not require the entire Platform to be deployed and run on small devices.

## Security

Client-side TLS 1.2 enabled by default

New variant of `AccessController.doPrivileged` that enables code to assert a subset of its privileges, without preventing the full traversal of the stack to check for other permissions

Stronger algorithms for password-based encryption

SSL/TLS Server Name Indication (SNI) Extension support in JSSE Server

Support for AEAD algorithms: The SunJCE provider is enhanced to support AES/GCM/NoPadding cipher implementation as well as GCM algorithm parameters. And the SunJSSE provider is enhanced to support AEAD mode based cipher suites. See Oracle Providers Documentation, JEP 115.

KeyStore enhancements, including the new Domain KeyStore type `java.security.DomainLoadStoreParameter`, and the new command option `-importpassword` for the keytool utility

SHA-224 Message Digests

Enhanced Support for NSA Suite B Cryptography

Better Support for High Entropy Random Number Generation

New `java.security.cert.PKIXRevocationChecker` class for configuring revocation checking of X.509 certificates

64-bit PKCS11 for Windows

New rcache Types in Kerberos 5 Replay Caching

Support for Kerberos 5 Protocol Transition and Constrained Delegation

Kerberos 5 weak encryption types disabled by default

Unbound SASL for the GSS-API/Kerberos 5 mechanism

SASL service for multiple host names

JNI bridge to native JGSS on Mac OS X

Support for stronger strength ephemeral DH keys in the SunJSSE provider

Support for server-side cipher suites preference customization in JSSE

## JavaFX

The new Modena theme has been implemented in this release. For more information, see the blog at fxexperience.com.

The new `SwingNode` class enables developers to embed Swing content into JavaFX applications. See the `SwingNode` javadoc and Embedding Swing Content in JavaFX Applications.

The new UI Controls include the `DatePicker` and the `TreeTableView` controls.

The `javafx.print` package provides the public classes for the JavaFX Printing API. See the javadoc for more information.

The 3D Graphics features now include 3D shapes, camera, lights, subscene, material, picking, and antialiasing. The new `Shape3D` (`Box`, `Cylinder`, `MeshView`, and `Sphere`subclasses), `SubScene`, `Material`, `PickResult`, `LightBase` (`AmbientLight` and`PointLight` subclasses) , and `SceneAntialiasing` API classes have been added to the JavaFX 3D Graphics library. The `Camera` API class has also been updated in this release. See the corresponding class javadoc for `javafx.scene.shape.Shape3D`,`javafx.scene.SubScene`, `javafx.scene.paint.Material`,`javafx.scene.input.PickResult`, `javafx.scene.SceneAntialiasing`, and theGetting Started with JavaFX 3D Graphics document.

The `WebView` class provides new features and improvements. Review Supported Features of HTML5 for more information about additional HTML5 features including Web Sockets, Web Workers, and Web Fonts.

Enhanced text support including bi-directional text and complex text scripts such as Thai and Hindi in controls, and multi-line, multi-style text in text nodes.

Support for Hi-DPI displays has been added in this release.

The CSS Styleable* classes became public API. See the `javafx.css` javadoc for more information.

The new `ScheduledService` class allows to automatically restart the service.

JavaFX is now available for ARM platforms. JDK for ARM includes the base, graphics and controls components of JavaFX.

### Tools

The `jjs` command is provided to invoke the Nashorn engine.

The `java` command launches JavaFX applications.

The `java` man page has been reworked.

The `jdeps` command-line tool is provided for analyzing class files.

Java Management Extensions (JMX) provide remote access to diagnostic commands.

The `jarsigner` tool has an option for requesting a signed time stamp from a Time Stamping Authority (TSA).

#### Javac tool

The `-parameters` option of the `javac` command can be used to store formal parameter names and enable the Reflection API to retrieve formal parameter names.

The type rules for equality operators in the Java Language Specification (JLS) Section 15.21 are now correctly enforced by the `javac` command.

The `javac` tool now has support for checking the content of `javadoc` comments for issues that could lead to various problems, such as invalid HTML or accessibility issues, in the files that are generated when `javadoc` is run. The feature is enabled by the new `-Xdoclint` option. For more details, see the output from running "`javac -X`". This feature is also available in the `javadoc` tool, and is enabled there by default.

The `javac` tool now provides the ability to generate native headers, as needed. This removes the need to run the `javah` tool as a separate step in the build pipeline. The feature is enabled in `javac` by using the new `-h` option, which is used to specify a directory in which the header files should be written. Header files will be generated for any class which has either native methods, or constant fields annotated with a new annotation of type `java.lang.annotation.Native`.

#### Javadoc tool

The `javadoc` tool supports the new `DocTree` API that enables you to traverse Javadoc comments as abstract syntax trees.

The `javadoc` tool supports the new Javadoc Access API that enables you to invoke the Javadoc tool directly from a Java application, without executing a new process. See the javadoc what's new page for more information.

The `javadoc` tool now has support for checking the content of `javadoc` comments for issues that could lead to various problems, such as invalid HTML or accessibility issues, in the files that are generated when `javadoc` is run. The feature is enabled by default, and can also be controlled by the new `-Xdoclint` option. For more details, see the output from running "`javadoc -X`". This feature is also available in the `javac` tool, although it is not enabled by default there.

### Internationalization

Unicode Enhancements, including support for Unicode 6.2.0

Adoption of Unicode CLDR Data and the java.locale.providers System Property

New Calendar and Locale APIs

Ability to Install a Custom Resource Bundle as an Extension

### Deployment

For sandbox applets and Java Web Start applications, `URLPermission` is now used to allow connections back to the server from which they were started. `SocketPermission` is no longer granted.

The Permissions attribute is required in the JAR file manifest of the main JAR file at all security levels.

### Date-Time Package - a new set of packages that provide a comprehensive date-time model.

### Scripting

Nashorn Javascript Engine

### Pack200

Pack200 Support for Constant Pool Entries and New Bytecodes Introduced by JSR 292

JDK8 support for class files changes specified by JSR-292, JSR-308 and JSR-335

### IO and NIO

New `SelectorProvider` implementation for Solaris based on the Solaris event port mechanism. To use, run with the system property `java.nio.channels.spi.Selector`set to the value `sun.nio.ch.EventPortSelectorProvider`.

Decrease in the size of the `<JDK_HOME>/jre/lib/charsets.jar` file

Performance improvement for the `java.lang.String(byte[], *)` constructor and the`java.lang.String.getBytes()` method.

### java.lang and java.util Packages

Parallel Array Sorting

Standard Encoding and Decoding Base64

Unsigned Arithmetic Support

### JDBC

The JDBC-ODBC Bridge has been removed.

JDBC 4.2 introduces new features.

### Java DB

JDK 8 includes Java DB 10.10.

### Networking

The class `java.net.URLPermission` has been added.

In the class `java.net.HttpURLConnection`, if a security manager is installed, calls that request to open a connection require permission.

### Concurrency

Classes and interfaces have been added to the `java.util.concurrent` package.

Methods have been added to the `java.util.concurrent.ConcurrentHashMap` class to support aggregate operations based on the newly added streams facility and lambda expressions.

Classes have been added to the `java.util.concurrent.atomic` package to support scalable updatable variables.

Methods have been added to the `java.util.concurrent.ForkJoinPool` class to support a common pool.

The `java.util.concurrent.locks.StampedLock` class has been added to provide a capability-based lock with three modes for controlling read/write access.

### Java XML - JAXP

### HotSpot

Hardware intrinsics were added to use Advanced Encryption Standard (AES). The`UseAES` and `UseAESIntrinsics` flags are available to enable the hardware-based AES intrinsics for Intel hardware. The hardware must be 2010 or newer Westmere hardware. For example, to enable hardware AES, use the following flags:

```
-XX:+UseAES -XX:+UseAESIntrinsics
```
To disable hardware AES use the following flags:

```
-XX:-UseAES -XX:-UseAESIntrinsics
```

Removal of PermGen.

Default Methods in the Java Programming Language are supported by the byte code instructions for method invocation.

### Java Mission Control 5.3 Release Notes

JDK 8 includes Java Mission Control 5.3.