



Java version history

The Java language has undergone several changes since JDK 1.0 as well as numerous additions of classes and packages to the standard library. Since J2SE 1.4, the evolution of the Java language has been governed by the Java Community Process (JCP), which uses *Java Specification Requests (JSRs)* to propose and specify additions and changes to the Java platform. The language is specified by the *Java Language Specification (JLS)*; changes to the JLS are managed under JSR 901 (<http://www.jcp.org/en/jsr/detail?id=901>). In September 2017, Mark Reinhold, chief Architect of the Java Platform, proposed to change the release train to "one feature release every six months" rather than the then current two-year schedule.^{[1][2]} This proposal took effect for all following versions, and is still the current release schedule.

In addition to the language changes, other changes have been made to the Java Class Library over the years, which has grown from a few hundred classes in JDK 1.0 to over three thousand in J2SE 5. Entire new APIs, such as Swing and Java2D, have been introduced, and many of the original JDK 1.0 classes and methods have been deprecated. Some programs allow conversion of Java programs from one version of the Java platform to an older one (for example Java 5.0 backported to 1.4) (see Java backporting tools).

Regarding Oracle Java SE Support Roadmap,^[3] version 21 is the latest one, and versions 21, 17, 11 and 8 are the currently supported long-term support (LTS) versions, where Oracle Customers will receive Oracle Premier Support. Oracle continues to release no-cost public Java 8 updates for development^[3] and personal use indefinitely. Oracle also continues to release no-cost public Java 17 LTS updates for all users, including commercial and production use until September 2024.^[4]

In the case of OpenJDK, both commercial long-term support and free software updates are available from multiple organizations in the broader community.^[5]

Java 21, the latest (4th) LTS, was released on September 19, 2023.

Release table

Version	Class File Format Version ^[6]	Release date	End of Public Updates (Free)	End of Extended Support (Paid)
JDK 1 0	45	23rd January 1996	May 1996	
JDK 1.1	45	18th February 1997	October 2002	—
J2SE 1 2	46	4th December 1998	November 2003	
J2SE 1.3	47	8th May 2000	March 2006	—
J2SE 1 4	48	13th February 2002	October 2008	
J2SE 5.0	49	30th September 2004	October 2009	—
Java SE 6	50	11th December 2006	April 2013	December 2016 for Red Hat ^[7] October 2018 for Oracle ^[8] December 2027 for Azul ^[9]
Java SE 7	51	28th July 2011	July 2015	June 2020 for Red Hat ^[7] July 2022 for Oracle ^[10] December 2027 for Azul ^[9]
Java SE 8 (LTS)	52	18th March 2014	April 2019 for Oracle July 2026 for Amazon Corretto ^[11] November 2026 for Eclipse Temurin ^[12] November 2026 for Red Hat ^[7] December 2030 for Azul ^[9]	December 2030 for Oracle ^[13]
Java SE 9	53	21st September 2017	March 2018	—
Java SE 10	54	20th March 2018	September 2018	—
Java SE 11 (LTS)	55	25th September 2018	April 2019 for Oracle October 2024 for Eclipse Temurin ^[12] October 2024 for Red Hat ^[7] October 2027 for Amazon Corretto ^[11] January 2032 for Azul ^[9]	January 2032 for Oracle ^[13]
Java SE 12	56	19th March 2019	September 2019	
Java SE 13	57	17th September 2019	March 2020	—

Java SE 14	58	17th March 2020	September 2020	
Java SE 15	59	16th September 2020	March 2021	—
Java SE 16	60	16th March 2021	September 2021	
Java SE 17 (LTS)	61	14th September 2021	September 2024 for Oracle ^[14] October 2027 for Eclipse Temurin ^[12] October 2027 for Red Hat ^[7] October 2028 for Amazon Corretto ^[11] September 2029 for Azul ^[9]	September 2029 for Oracle ^[13]
Java SE 18	62	22nd March 2022	September 2022	—
Java SE 19	63	20th September 2022	March 2023	—
Java SE 20	64	21st March 2023	September 2023	—
Java SE 21 (LTS)	65	19th September 2023	September 2026 for Oracle ^[14] September 2029 for Eclipse Temurin ^[12] September 2029 for Red Hat ^[7] October 2030 for Amazon Corretto ^[11] September 2031 for Azul ^[9]	September 2031 for Oracle ^[13]
Java SE 22	66	19th March 2024	September 2024	
Legend: ■ Old version ■ Older version, still maintained ■ Latest version ■ Future release				

JDK 1.0

The first version was released on January 23, 1996.^{[15][16]} The first stable version, JDK 1.0.2, is called Java 1.^[16]

JDK 1.0

Released	January 23, 1996
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JDK 1.1

Major additions in the release on February 19, 1997 included:^[17]

JDK 1.1

Released	February 19, 1997
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- an extensive retooling of the AWT event model
- inner classes added to the language
- JavaBeans
- JDBC
- RMI and serialization
- reflection which supported Introspection only, no modification at runtime was possible. (The ability to modify objects reflectively was added in J2SE 1.2, by introducing the AccessibleObject (<https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/lang/reflect/AccessibleObject.html>))

class and its subclasses such as the `Field` (<https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/lang/reflect/Field.html>) class.)

- JIT (Just In Time) compiler on Microsoft Windows platforms, produced for JavaSoft by Symantec
- Internationalization and Unicode support originating from Taligent^[18]

J2SE 1.2

The release on December 8, 1998 and subsequent releases through J2SE 5.0 were rebranded retrospectively **Java 2** and the version name "J2SE" (Java 2 Platform, Standard Edition) replaced JDK to distinguish the base platform from J2EE (Java 2 Platform, Enterprise Edition) and J2ME (Java 2 Platform, Micro Edition). This was a very significant release of Java as it tripled the size of the Java platform to 1520 classes in 59 packages. Major additions included:^[19]

- `strictfp` keyword (by JVM 17 an obsolete keyword, shouldn't be used in new code)
- the `Swing` graphical API was integrated into the core classes
- Sun's JVM was equipped with a `JIT compiler` for the first time
- `Java plug-in`
- `Java IDL`, an `IDL` implementation for `CORBA` interoperability
- `Collections` framework

J2SE 1.2

Codename	Playground
Released	December 8, 1998

J2SE 1.3

The most notable changes in the May 8, 2000 release were:^{[20][21]}

- HotSpot JVM included (the HotSpot JVM was first released in April 1999 for the J2SE 1.2 JVM)
- RMI was modified to support optional compatibility with `CORBA`
- `Java Naming and Directory Interface` (JNDI) included in core libraries (previously available as an extension)
- `Java Platform Debugger Architecture` (JPDA)
- `JavaSound`
- `Synthetic proxy classes`

J2SE 1.3

Codename	Kestrel
Released	May 8, 2000

Java 1.3 is the last release of Java to officially support Microsoft `Windows 95`.^[22]

J2SE 1.4

The February 6, 2002 release was the first release of the Java platform developed under the Java Community Process as JSR 59 (<http://www.jcp.org/en/jsr/detail?id=59>). Major changes included:^{[23][24]}

- Language changes

J2SE 1.4

Codename	Merlin
Released	February 6, 2002
Support ended	

- `assert` keyword (specified in JSR 41 (<https://web.archive.org/web/20080616233205/http://www.jcp.org/en/jsr/detail?id=41>))

Public	October 2008
Paid	February 2013

- Library improvements
 - Regular expressions modeled after Perl regular expressions
 - Exception chaining allows an exception to encapsulate original lower-level exception
 - Internet Protocol version 6 (IPv6) support
 - Non-blocking I/O (named NIO) (specified in JSR 51 (<http://www.jcp.org/en/jsr/detail?id=51>))
 - Logging API (specified in JSR 47 (<http://www.jcp.org/en/jsr/detail?id=47>))
 - Image I/O API for reading and writing images in formats like JPEG and PNG
 - Integrated XML parser and XSLT processor (JAXP) (specified in JSR 5 (<http://www.jcp.org/en/jsr/detail?id=5>) and JSR 63 (<http://www.jcp.org/en/jsr/detail?id=63>))
 - Integrated security and cryptography extensions (JCE, JSSE, JAAS)
 - Java Web Start included (Java Web Start was first released in March 2001 for J2SE 1.3) (specified in JSR 56 (<http://www.jcp.org/en/jsr/detail?id=56>))
 - Preferences API (`java.util.prefs`)

Public support and security updates for Java 1.4 ended in October 2008. Paid security updates for Oracle customers ended in February 2013.^[25]

Java SE 5

The release on September 30, 2004 was originally numbered 1.5, which is still used as the internal version number. The number was changed to "better reflect the level of maturity, stability, scalability and security of the J2SE".^[26] This version was developed under JSR 176 (<http://www.jcp.org/en/jsr/detail?id=176>).

Java SE 5 entered its end-of-public-updates period on April 8, 2008; updates are no longer available to the public as of November 3, 2009. Updates were available to paid Oracle customers until May 2015.^[3]

Java SE 5

Codename	Tiger
Released	September 30, 2004
Support ended	
Public	November 2009
Paid	April 2015

Tiger added a number of significant new language features:^{[27][28]}

- Generics: provides compile-time (static) type safety for collections and eliminates the need for most typecasts (type conversion) (specified by JSR 14 (<http://www.jcp.org/en/jsr/detail?id=14>))
- Metadata: also called annotations; allows language constructs such as classes and methods to be tagged with additional data, which can then be processed by metadata-aware utilities (specified by JSR 175 (<http://www.jcp.org/en/jsr/detail?id=175>))
- Autoboxing/unboxing automatic conversions between primitive types (such as `int`) and primitive wrapper classes (such as `Integer` (<https://docs.oracle.com/en/java/javase/19/docs/api/java.base/java/lang/Integer.html>)) (specified by JSR 201 (<http://www.jcp.org/en/jsr/detail?id=201>))
- Enumerations: the `enum` keyword creates a typesafe, ordered list of values (such as `Day.MONDAY`, `Day.TUESDAY`, etc.); previously this could only be achieved by non-typesafe constant integers or

manually constructed classes (typesafe enum pattern) (specified by JSR 201 (<http://www.jcp.org/en/jsr/detail?id=201>))

- Varargs: the last parameter of a method can now be declared using a type name followed by three dots (e.g. `void drawtext(String... lines)`); in the calling code any number of parameters of that type can be used and they are then placed in an array to be passed to the method, or alternatively the calling code can pass an array of that type
- Enhanced for each loop: the for loop syntax is extended with special syntax for iterating over each member of either an array or any Iterable (<https://docs.oracle.com/en/java/javase/19/docs/api/java.base/java/lang/Iterable.html>), such as the standard Collection (<https://docs.oracle.com/en/java/javase/19/docs/api/java.base/java/util/Collection.html>) classes (specified by JSR 201 (<http://www.jcp.org/en/jsr/detail?id=201>))
- Improved semantics of execution for multi-threaded Java programs; the new Java memory model addresses issues of complexity, effectiveness, and performance of previous specifications^[29]
- Static imports

There were also the following improvements to the standard libraries:

- Automatic stub generation for RMI objects
- Swing: New skinnable look and feel, called synth
- The concurrency utilities (<https://java.sun.com/j2se/1.5.0/docs/guide/concurrency/overview.html>) in package `java.util.concurrent` (<https://java.sun.com/j2se/1.5.0/docs/api/java/util/concurrent/package-summary.html>)^[30]
- Scanner class for parsing data from various input streams and buffers

Java 5 is the last release of Java to officially support Microsoft Windows 98 and Windows ME,^[31] while Windows Vista was the newest version of Windows that Java SE 5 was supported on prior to Java 5 going end-of-life in October of 2009.^[25]

Java 5 Update 5 (1.5.0_05) is the last release of Java to work on Windows 95 (with Internet Explorer 5.5 installed) and Windows NT 4.0.^[32]

Java 5 was first available on Apple Mac OS X 10.4 (Tiger)^[33] and was the default version of Java installed on Apple Mac OS X 10.5 (Leopard).

Public support and security updates for Java 1.5 ended in November 2009. Paid security updates for Oracle customers ended in April 2015.

Versioning change

This version introduced a new versioning system for the Java language, although the old versioning system continued to be used for developer libraries:

Both version numbers "1.5.0" and "5.0" are used to identify this release of the Java 2 Platform Standard Edition. Version "5.0" is the product version, while "1.5.0" is the developer version. The number "5.0" is used to better reflect the level of maturity, stability, scalability and security of the J2SE.

—"Version 1.5.0 or 5.0?", Java release notes^[34]

This correspondence continued through later releases (Java 6 = JDK 1.6, Java 7 = JDK 1.7, and so on).

Java SE 6

As of the version released on December 11, 2006, Sun replaced the name "J2SE" with **Java SE** and dropped the ".o" from the version number.^[35] Internal numbering for developers remains 1.6.0.^[36]

This version was developed under JSR 270 (<http://www.jcp.org/en/jsr/detail?id=270>).

Java SE 6

Codename	Mustang
Released	November 11, 2006
Support ended	
Public	February 2013

During the development phase, new builds including enhancements and bug fixes were released approximately weekly. Beta versions were released in February and June 2006, leading up to a final release that occurred on December 11, 2006.

Major changes included in this version:^[37]^[38]

- Support for older Win9x versions dropped; unofficially, Java 6 Update 7 was the last release of Java shown to work on these versions of Windows. This is believed to be due to the major changes in Update 10.
- Scripting Language Support (JSR 223): Generic API for tight integration with scripting languages, and built-in Mozilla JavaScript Rhino integration.
- Dramatic performance improvements for the core platform,^[39]^[40] and Swing.
- Improved Web Service support through JAX-WS (JSR 224).
- JDBC 4.0 support (JSR 221).
- Java Compiler API (JSR 199): an API allowing a Java program to select and invoke a Java Compiler programmatically.
- Upgrade of JAXB to version 2.0: Including integration of a StAX parser.
- Support for pluggable annotations (JSR 269).^[41]
- Many GUI improvements, such as integration of SwingWorker in the API, table sorting and filtering, and true Swing double-buffering (eliminating the gray-area effect).
- JVM improvements include: synchronization and compiler performance optimizations, new algorithms and upgrades to existing garbage collection algorithms, and application start-up performance.

Java 6 can be installed to Mac OS X 10.5 (Leopard) running on 64-bit (Core 2 Duo and higher) processor machines.^[42] Java 6 is also supported by both 32-bit and 64-bit machines running Mac OS X 10.6 (Snow Leopard).

Java 6 reached the end of its supported life in February 2013, at which time all public updates, including security updates, were scheduled to be stopped.^[43]^[44] Oracle released two more updates to Java 6 in March and April 2013, which patched some security vulnerabilities.^[45]^[46]

Java 6 updates

After Java 6 release, Sun, and later Oracle, released several updates which, while not changing any public API, enhanced end-user usability or fixed bugs.^[47]

Table of Java 6 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 6	2006-12-23	This release adds many enhancements in the fields of Web services, scripting, databases, pluggable annotations, and security, as well as quality, compatibility, and stability. JConsole is now officially supported. Java DB support has been added.
Java SE 6 Update 1	2007-05-07	
Java SE 6 Update 2	2007-07-03	
Java SE 6 Update 3	2007-10-03	
Java SE 6 Update 4	2008-01-14	HotSpot VM 10
Java SE 6 Update 5	2008-03-05	Several security flaws were eliminated. New root certificates from AOL, DigiCert, and TrustCenter are now included.
Java SE 6 Update 6	2008-04-16	A workaround for the infamous Xlib/XCB locking assertion issue was introduced. A memory leak when using Kerberos authentication with LoginContext was fixed. Several other bugs were fixed.
Java SE 6 Update 7		Unofficially, Java SE 6 Update 7 (1.6.0.7) is the last version of Java that was shown to be working on the Win9x family of operating systems
Java SE 6 Update 10	2008-10-15	HotSpot VM 11. Major changes for this update include: ▪ Java Deployment Toolkit, a set of JavaScript functions to ease the deployment of <u>applets</u> and <u>Java Web Start</u> applications.^[48] ▪ Java Kernel, a small installer including only the most commonly used JRE classes. Other packages are downloaded when needed. ▪ Enhanced updater. ▪ Enhanced versioning and pack200 support: server-side support is no longer required.^[48] ▪ Java Quick Starter, to improve cold start-up time. ▪ Improved performance of Java2D graphics primitives on Windows, using <u>Direct3D</u> and hardware acceleration. ▪ A new <u>Swing look and feel</u> called Nimbus and based on <u>synth</u>.^[49] ▪ Next-Generation Java Plug-In: applets now run in a separate process and support many features of Web Start applications.^[48]
Java SE 6 Update 11 ^[50]	2008-12-03	13 security fixes
Java SE 6 Update 12	2008-12-12	No security fixes; 64-bit Java plug-in (for 64-bit web browsers only); Windows Server 2008 support; performance improvements of graphics and <u>JavaFX</u> applications
Java SE 6 Update 13	2009-03-24	7 security fixes, JNDI store and retrieve Java objects in LDAP slightly modified, JMX Change (createMBeanunregisterMBean), 4 new root certificates added
Java SE 6 Update 14	2009-05-28	HotSpot VM 14. This release includes extensive performance updates to the JIT compiler, compressed pointers for 64-bit machines, as well as support for the <u>G1</u> (Garbage First) low-pause garbage collector.^{[51][52]} The <code>-XX:+DoEscapeAnalysis</code> option directs the HotSpot JIT compiler to use escape analysis to determine whether local objects can be allocated on the <u>stack</u> instead of the <u>heap</u>.

		Some developers have noticed an issue introduced in this release which causes debuggers to miss breakpoints seemingly randomly. ^[53] Sun has a corresponding bug, which is tracking the issue. The workaround applies to the Client and Server VMs. ^[54] Using the -XX:+UseParallelGC option will prevent the failure. Another workaround is to roll back to update 13, or to upgrade to update 16.
Java SE 6 Update 15	2009-08-04	Introduced patch-in-place functionality
Java SE 6 Update 16	2009-08-11	Fixed the issue introduced in update 14 which caused debuggers to miss breakpoint
Java SE 6 Update 17	2009-11-04	Security fixes; two new root certificates
Java SE 6 Update 18	2010-01-13	No security fixes; Hotspot VM 16; support for Ubuntu 8.04 LTS Desktop Edition, SLES 11, Windows 7, Red Hat Enterprise Linux 5.3, Firefox 3.6, VisualVM 1.2; updated Java DB; many performance improvements
Java SE 6 Update 19	2010-03-30	Security fixes; root certificate changes: seven new, three removed, five replaced with stronger signature algorithm; interim fix for TLS renegotiation attack
Java SE 6 Update 20	2010-04-15	2 security fixes
Java SE 6 Update 21	2010-07-07	No security fixes; Hotspot VM 17; support for Red Hat Enterprise Linux 5.4 and 5.5, Oracle Enterprise Linux 4.8, 5.4, 5.5; Google Chrome 4 support; support for Customized Loading Progress Indicators; VisualVM 1.2.2
Java SE 6 Update 22	2010-10-12	29 security fixes; RFC 5746 (http://datatracker.ietf.org/doc/html/rfc5746) support
Java SE 6 Update 23	2010-12-08	No security fixes; Hotspot VM 19; better support for right-to-left language
Java SE 6 Update 24	2011-02-15	21 security fixes; updated Java DB
Java SE 6 Update 25	2011-03-21	No security fixes; Hotspot VM 20; support for Internet Explorer 9, Firefox 4 and Chrome 10; improved BigDecimal; includes "tiered" compilation in the Server VM that enable it to start quickly on the Client VM, while achieving better peak performance (this feature is enabled by specifying -server and -XX:+TieredCompilation command options)
Java SE 6 Update 26	2011-06-07	17 new security fixes; ^[55] last version compatible with Windows Vista SP1
Java SE 6 Update 27	2011-08-16	No security fixes; certification for Firefox 5
Java SE 6 Update 29	2011-10-18	20 security fixes, various bug fixes ^[56]
Java SE 6 Update 30	2011-12-12	No security fixes; fix for SSL regression in Update 29; support for Red Hat Enterprise Linux 6
Java SE 6 Update 31	2012-02-14	14 security fixes and one bug fix; last version work reliably for Windows 2000 ^[57]
Java SE 6 Update 32	2012-04-26	No security fixes, various bug fixes
Java SE 6 Update 33	2012-06-12	14 security fixes, improved VM configuration file loading

Java SE 6 Update 34	2012 08 14	No security fix e , variou bug fi e
Java SE 6 Update 35	2012 08 30	Contains a security-in-depth fix ^[58]
Java SE 6 Update 37	2012 10 16	30 security fi e
Java SE 6 Update 38	2012-12-11	Various bug fixes
Java SE 6 Update 39	2013-02-01	50 security fixes
Java SE 6 Update 41	2013 02 19	5 security fi e
Java SE 6 Update 43	2013-03-04	2 security fixes
Java SE 6 Update 45	2013-04-16	42 security fixes; ^[59] other changes; final public update. ^[60]
Java SE 6 Update 51	2013-06-18	Not available publicly, only available through the Java SE Support program and in Apple Update for OS X Snow Leopard, Lion & Mountain Lion; up to 40 security fixes ^[61]
Java SE 6 Update 65	2013-10-15	Not available publicly, only available through the Java SE Support program and in Apple Update for OS Snow Leopard, Lion & Mountain Lion; at least 11 critical security fixes ^[62]
Java SE 6 Update 71	2014 01 14	Not available for public download; 33 fi e
Java SE 6 Update 75	2014-04-15	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster no. #54; 25 security fixes ^[63]
Java SE 6 Update 81	2014-07-15	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 11 security fixes ^[64]
Java SE 6 Update 85	2014-10-16	Not available publicly, only available through the Java SE Support program and in Solari 10' Recommended Patch et Clu ter; 18 security fixes ^[65]
Java SE 6 Update 91	2015-01-21	Linux 64 and Windows i586 version are available at the Java SE 6 Reference Implementation. ^[66] Other versions are only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 15 security fixes ^[67]
Java SE 6 Update 95	2015-04-14	Not available publicly, only available through the Java SE Support program and in Solari 10' Recommended Patch et Clu ter; 14 security fixes ^[68]
Java SE 6 Update 101	2015-07-15	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 18 security fixes ^[69] Certification for IE 10 and 11 was introduced in 1.6.0_101
Java SE 6 Update 105	2015-10-20	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 17 security fixes ^[70]
Java SE 6 Update 111	2016-01-20	Not available publicly, only available through the Java SE Support program and in Solari 10' Recommended Patch et Clu ter; 13 security fixes ^[71]
Java SE 6 Update 113	2016 02 05	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 1 security fix ^[72]
Java SE 6 Update 115	2016-04-21	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 8

		security fixes ^[73]
Java SE 6 Update 121	2016-07-19	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 15 security fixes ^[74]
Java SE 6 Update 131	2016-10-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 13 security fixes ^[75]
Java SE 6 Update 141	2017-01-17	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 17 security fixes ^[76]
Java SE 6 Update 151	2017-04-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 10 security fixes ^[77]
Java SE 6 Update 161	2017-07-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 5 security fixes ^[78]
Java SE 6 Update 171	2017-10-20	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 7 security fixes ^[79]
Java SE 6 Update 181	2018-01-16	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 12 security fixes ^[80]
Java SE 6 Update 191	2018-04-17	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 7 security fixes ^[81]
Java SE 6 Update 201	2018-07-17	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 3 security fixes ^[82]
Java SE 6 Update 211	2018-10-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 8 security fixes ^[83]

Java SE 7

Java 7 was a major update that launched on July 7, 2011^[85] and was made available for developers on July 28, 2011.^[86] The development period was organized into thirteen milestones; on June 6, 2011, the last of the thirteen milestones was finished.^{[86][87]} On average, 8 builds (which generally included enhancements and bug fixes) were released per milestone. The feature list at the OpenJDK 7 project (<https://openjdk.java.net/projects/jdk7/features/>) lists many of the changes.

Java SE 7

Codename	Dolphin ^[84]
Released	July 28, 2011
Support ended	
Public	April 2015
Paid	June 2022

Additions in Java 7 include:^[88]

- JVM support for dynamic languages, with the new `invokedynamic` bytecode under JSR-292,^[89] following the prototyping work currently done on the Multi Language Virtual Machine
- Compressed 64-bit pointers^[90] (available in Java 6 with `-XX:+UseCompressedOops`)^[91]

- These small language changes (grouped under a project named Coin):^[92]
 - Strings in switch^[93]
 - Automatic resource management in try-statement aka *try-with-resources statement*^[94]
 - Improved type inference for generic instance creation, aka *the diamond operator* <>^[95]
 - Simplified varargs method declaration^[96]
 - Binary integer literals^[97]
 - Allowing underscores in numeric literals^[98]
 - Catching multiple exception types and rethrowing exceptions with improved type checking^[99]
- Concurrency utilities under JSR 166^[100]
- New file I/O library (defined by JSR 203) adding support for multiple file systems, file metadata and symbolic links. The new packages are `java.nio.file`, `java.nio.file.attribute` and `java.nio.file.spi`^{[101][102]}
- Timsort is used to sort collections and arrays of objects instead of merge sort
- Library-level support for elliptic curve cryptography algorithms
- An XRender pipeline for Java 2D, which improves handling of features specific to modern GPUs
- New platform APIs for the graphics features originally implemented in version 6u10 as unsupported APIs^[103]
- Enhanced library-level support for new network protocols, including SCTP and Sockets Direct Protocol
- Upstream updates to XML and Unicode
- Java deployment rule sets^[104]

Lambda (Java's implementation of lambda functions), Jigsaw (Java's implementation of modules), and part of Coin were dropped from Java 7, and released as part of Java 8 (except for Jigsaw, which was released in Java 9).^{[105][106]}

Java 7 was the default version to download on java.com from April 2012 until Java 8 was released.^[107]

Java 7 updates

Oracle issued public updates to the Java 7 family on a quarterly basis^[108] until April 2015 when the product reached the end of its public availability.^[109] Further updates for JDK 7, which continued until July 2022, are only made available to customers with a support contract.^[110]

Table of Java 7 updates [show]

Release	Release date	Highlights
Java SE 7 ^[111]	2011-07-28	Initial release; <u>HotSpot VM 21</u>
Java SE 7 Update 1	2011-10-18	20 security fixes, other bug fixes
Java SE 7 Update 2	2011-12-12	No security fix e ; HotSpot VM 22; reliability and performance improvements; support for <u>Solaris 11</u> and <u>Firefox 5</u> and later; <u>JavaFX</u> included with Java SE JDK, improvements for web-deployed applications
Java SE 7 Update 3	2012-02-14	14 security fixes ^[112]
Java SE 7 Update 4	2012 04 26	No security update ; HotSpot VM 23; JDK Support for Mac OS
Java SE 7 Update 5	2012 06 12	14 security fixes ^[113]
Java SE 7 Update 6	2012 08 14	JavaF and Java Acce Bridge included in Java SE JDK and JRE installation, JavaFX support for touch-enabled monitors and touch pads, JavaFX support for Linux, JDK and JRE Support for Mac OS X, JDK for Linux on ARM ^[114]
Java SE 7 Update 7	2012 08 30	4 security fixes ^[58]
Java SE 7 Update 9	2012-10-16	30 security vulnerabilities fixes ^[115]
Java SE 7 Update 10	2012 12 11	New security features, such as the ability to disable any Java application from running in the browser and new dialog to warn you when the JRE is insecure, and bug fixes
Java SE 7 Update 11	2013 01 13	Olson Data 2012i; bugfix for problems with registration of plugin on y tem with Stand alone ver ion of JavaF In talled, ecurity fixes for <u>CVE-2013-0422</u> (https://www.cve.org/CVERecord?id=CVE-2013-0422), ^[116] the default security level for Java applets and web tart application ha been increa ed from "Medium" to "High"
Java SE 7 Update 13 ^[117]	2013-02-01	50 security fixes
Java SE 7 Update 15	2013-02-19	5 security fixes
Java SE 7 Update 17	2013-03-04	2 security fixes
Java SE 7 Update 21	2013 04 16	Multiple changes including 42 security fixes, a new Server JRE that doe n't include the plug in, and the JDK for Linu on ARM
Java SE 7 Update 25	2013 06 18	Multiple changes including 40 security fixes ^{[61][118]}
Java SE 7 Update 40	2013-09-10	621 bug fixes, ^[119] New security features, <u>hardfloat ARM</u> , Java Mission Control 5.2 and <u>Retina Display</u> support ^[120]
Java SE 7 Update 45	2013-10-15	51 security fixes; ^[62] protections against unauthorized redistribution of Java applications; restore security prompts; JAXP changes; <u>TimeZone.setDefault</u> change
Java SE 7 Update 51	2014-01-14	36 security fixes; block JAVA applets without manifest (like Remote con ole Java Applet IBM IMM card, HP iLO card) even if warning dialog is with sentence "will be blocked in next version", ^{[121][122]} 17 bug fixes
Java SE 7 Update 55	2014 04 15	37 security fixes, ^[63] 19 bug fixes ^[123]
Java SE 7 Update 60	2014-05-28	Java Mission Control 5.3, ^[124] 130 bug fixes ^[125]
Java SE 7 Update 65	2014-07-15	18 bug fixes

Java SE 7 Update 67	2014 08 04	1 bug fi
Java SE 7 Update 71	2014-10-14	16 bug fixes
Java SE 7 Update 72	2014-10-14	Same release date with Update 71 as a corresponding Patch Set Update (PSU) for Java SE 7, ^[126] 36 bug fixes
Java SE 7 Update 75	2015-01-20	12 bug fixes, SSLv3 disabled by default
Java SE 7 Update 76	2015-01-20	Same release date with Update 75 as a corresponding Patch Set Update (PSU) for Java SE 7, ^[126] 97 bug fixes
Java SE 7 Update 79	2015 04 14	21 security fi e , 6 bug fi e ,
Java SE 7 Update 80	2015-04-14	Last public release of Java 7; same release date with Update 79 as a corresponding Patch Set Update (PSU) for Java SE 7, 104 bug fixes
Java SE 7 Update 85	2015 07 15	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 25 security fixes ^[127]
Java SE 7 Update 91	2015-10-20	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 20 security fixes ^[128]
Java SE 7 Update 95	2016-01-19	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patch set Cluster; 8 security fixes ^[129]
Java SE 7 Update 97	2016-02-05	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patch set Cluster; 1 security fix ^[72]
Java SE 7 Update 99	2016 03 23	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 1 security fix ^[130]
Java SE 7 Update 101	2016-04-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 22 security fixes ^[131]
Java SE 7 Update 111	2016-07-19	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 36 security fixes ^[74]
Java SE 7 Update 121	2016-10-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patch set Cluster; 32 security fixes ^[75]
Java SE 7 Update 131	2017 01 17	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 34 security fixes ^[76]
Java SE 7 Update 141	2017-04-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 8 security fixes ^[132]
Java SE 7 Update 151	2017-07-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 4 security fixes ^[78]
Java SE 7 Update 161	2017-10-20	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patch set Cluster; 4 security fixes ^[79]

Java SE 7 Update 171	2018 01 16	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 51 security fixes ^[80]
Java SE 7 Update 181	2018-04-17	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 12 security fixes ^[81]
Java SE 7 Update 191	2018-07-17	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 9 security fixes ^[82]
Java SE 7 Update 201	2018-10-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 13 security fixes ^[83]
Java SE 7 Update 211	2019 01 15	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 5 security fixes ^[133]
Java SE 7 Update 221	2019 04 16	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 5 security fixes ^[134]
Java SE 7 Update 231	2019-07-16	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 6 security fixes ^[135]
Java SE 7 Update 241	2019-10-15	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 15 security fixes ^[136]
Java SE 7 Update 251	2020-01-14	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 12 security fixes ^[137]
Java SE 7 Update 261	2020 04 14	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 15 security fixes ^[138]
Java SE 7 Update 271	2020-07-14	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 11 security fixes ^[139]
Java SE 7 Update 281	2020-10-20	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 8 security fixes ^[140]
Java SE 7 Update 291	2021-01-19	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 1 security fixes ^[141]
Java SE 7 Update 301	2021 04 12	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 11 security fixes ^[142]
Java SE 7 Update 311	2021-07-20	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 24 bug fixes ^[143]
Java SE 7 Update 321	2021-10-19	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 16 bug fixes ^[144]

Java SE 7 Update 331	2022-01-18	Not available publicly, only available through the Java SE Support program and in Solaris 10's Recommended Patchset Cluster; 18 bug fixes ^[145]
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Java SE 8

Java 8 was released on March 18, 2014,^{[146][147]} and included some features that were planned for Java 7 but later deferred.^[148]

Work on features was organized in terms of JDK Enhancement Proposals (JEPs).^[149]

Java SE 8

<i>LTS version</i>	
Released	March 18, 2014
# of JEPs	8

- JSR 335, JEP 126: Language-level support for lambda expressions (officially, lambda expressions; unofficially, closures) under Project Lambda^[150] and default methods (virtual extension methods)^{[151][152][153]} which can be used to add methods to interfaces without breaking existing implementations. There was an ongoing debate in the Java community on whether to add support for lambda expressions.^{[154][155]} Sun later declared that lambda expressions would be included in Java and asked for community input to refine the feature.^[156] Supporting lambda expressions also enables functional-style operations on streams of elements, such as MapReduce-inspired transformations on collections. Default methods can be used by an author of an API to add new methods to an interface without breaking the old code using it. Although it was not their primary intent,^[151] default methods can also be used for multiple inheritance of behavior (but not state).
- JEP 174: Project Nashorn (<https://openjdk.java.net/jeps/174>), a JavaScript runtime which can run JavaScript code embedded within applications
- JEP 104: Annotation on Java types (<https://openjdk.java.net/jeps/104>)
- Unsigned integer arithmetic^[157]
- JEP 120: Repeating annotations (<https://openjdk.java.net/jeps/120>)
- JEP 150: Date and time API (<https://openjdk.java.net/jeps/150>)
- JEP 178: Statically-linked JNI libraries (<https://openjdk.java.net/jeps/178>)
- JEP 153: Launch JavaFX applications (<https://openjdk.java.net/jeps/153>) (direct launching of JavaFX application JARs)
- JEP 122: Remove the permanent generation (<https://openjdk.java.net/jeps/122>)

Java 8 is not supported on Windows XP^[158] but as of JDK 8 update 25, it can still be installed and run under Windows XP.^[159] Previous updates of JDK 8 could be run under XP by downloading archived zip format file and unzipping it for the executable. The last version of Java 8 could run on XP is update 251. But its components compatibility starts to break on unsupported OS in early build during Java 8 updates development.

From October 2014, Java 8 was the default version to download (and then again the download replacing Java 9) from the official website.^[160] "Oracle will continue to provide Public Updates and auto updates of Java SE 8, Indefinitely for Personal Users".^[161]

Java 8 updates

Table of Java 8 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 8	2014-03-18	Initial release
Java SE 8 Update 5 ^[162]	2014-04-15	Using "*" in Caller-Allowable-Codebase attribute; 11 bug fixes
Java SE 8 Update 11 ^[163]	2014-07-15	Java Dependency Analysis Tool (jdeps); Java Control Panel option to disable sponsors; JAR file attribute – Entry-Point; JAXP processing limit property – maxElementDepth; 18 security bug fixes, ^[164] 15 bug fixes
Java SE 8 Update 20 ^[165]	2014-08-19	669 bug fixes, ^[166] JMC 5.4, String deduplication (disabled by default)
Java SE 8 Update 25 ^[167]	2014-10-14	10 bug fixes
Java SE 8 Update 31 ^[168]	2015-01-19	26 bug fixes; SSLv3 (disabled by default)
Java SE 8 Update 40 ^[169]	2015-03-03	645 bug fixes, ^[170] Added the notion of "memory pressure" to help indicate how much of system's memory is still available (low pressure = high memory, high pressure = low memory)
Java SE 8 Update 45 ^[171]	2015-04-14	13 bug fixes
Java SE 8 Update 51 ^[172]	2015-07-14	Added support for native sandbox on Windows platforms (disabled by default); also, 25 security fixes, 14 bug fixes
Java SE 8 Update 60 ^[173]	2015-08-18	480 bug fixes ^[174]
Java SE 8 Update 65 ^[175]	2015-10-20	25 security fixes, 3 bug fixes
Java SE 8 Update 66 ^[176]	2015-11-16	15 bug fixes
Java SE 8 Update 71 ^[177]	2016-01-19	8 security fixes, 5 bug fixes ^[178]
Java SE 8 Update 72	2016-01-19	8 security fixes, 5 bug fixes, several enhancements
Java SE 8 Update 73 ^[179]	2016-02-03	1 security fix
Java SE 8 Update 74 ^[180]	2016-02-03	1 security fix
Java SE 8 Update 77 ^[181]	2016-03-23	1 security fix
Java SE 8 Update 91 ^[182]	2016-04-19	9 security fixes, 4 bug fixes and enhancements
Java SE 8 Update 92 ^[183]	2016-04-19	Security and bug fixes from 8u91, plus 76 additional bug fixes; the ExitOnOutOfMemoryError and CrashOnOutOfMemoryError flags have been introduced
Java SE 8 Update 101 ^[184]	2016-07-19	Security and bug fixes from 8u92, plus 9 additional bug fixes
Java SE 8 Update 102 ^[185]	2016-07-19	Security and bug fixes from 8u101, plus 118 additional bug fixes
Java SE 8 Update 111 ^[186]	2016-10-18	7 Security fixes and 9 bug fixes
Java SE 8 Update 112 ^[187]	2016-10-18	Additional features and 139 bug fixes over 8u111

Java SE 8 Update 121 ^[188]	2017-01-17	3 additional features, 5 changes, and 11 bug fixes over 8u112.
Java SE 8 Update 131 ^[189]	2017-04-18	4 changes and 42 bug fixes (2 notable).
Java SE 8 Update 141 ^[190]	2017-07-18	Additional feature, 3 changes and 12 bug fixes.
Java SE 8 Update 144 ^[191]	2017-07-26	32 Security fixes and bug fixes from 8u141.
Java SE 8 Update 151 ^[192]	2017-10-17	22 Security fixes, 2 notes, 1 certificate revocation, 1 new feature, 6 changes and 24 bug fixes from 8u144.
Java SE 8 Update 152 ^[193]	2017-10-17	Security fixes, 1 new feature, 1 change and 238 bug fixes from 8u151 (1 notable).
Java SE 8 Update 161 ^[194]	2018-01-16	21 Security fixes, 3 new features, 9 changes and 1 bug fix from 8u152.
Java SE 8 Update 162 ^[195]	2018-01-16	Security fixes, 63 bug fixes.
Java SE 8 Update 171 ^[196]	2018-04-17	Security fixes, bug fixes.
Java SE 8 Update 172 ^[197]	2018-04-17	Security fixes, bug fixes.
Java SE 8 Update 181 ^[198]	2018-07-17	Security fixes, bug fixes.
Java SE 8 Update 191 ^[199]	2018-10-16	New features, changes, bug fixes, security fixes.
Java SE 8 Update 192 ^[200]	2018-10-16	New features, changes, bug fixes.
Java SE 8 Update 201 ^[201]	2019-01-15	New features, changes, bug fixes.
Java SE 8 Update 202 ^[202]	2019-01-15	New features, changes, bug fixes.
Java SE 8 Update 211 ^[203]	2019-04-16	New features, changes, bug fixes. License Update.
Java SE 8 Update 212 ^[204]	2019-04-16	New features (e.g. 5 currency symbols, including for Bitcoin and "New Japanese Era Name <u>Reiwa</u> " ^[204]), changes, bug fixes. License Update.
Java SE 8 Update 221 ^[205]	2019-07-16	New features, changes, bug fixes.
Java SE 8 Update 231 ^[206]	2019-10-15	New features, changes, bug fixes and 18 security fixes.
Java SE 8 Update 241 ^[207]	2020-01-14	New features, changes, bug fixes.
Java SE 8 Update 251 ^[208]	2020-04-14	New features, changes, bug fixes. The last version that was shown to be working on Windows XP unofficially.
Java SE 8 Update 261 ^[209]	2020-07-14	New features, changes, 133 bug fixes. ^[210]
Java SE 8 Update 271 ^[211]	2020-10-20	New features, changes, 65 bug fixes. ^[212]
Java SE 8 Update 281 ^[213]	2021-01-19	New features, changes, 33 bug fixes. ^[214]
Java SE 8 Update 291 ^[215]	2021-04-20	New features, changes, 28 bug fixes. ^[216]
Java SE 8 Update 301 ^[217]	2021-07-20	New features, changes, 90 bug fixes. ^[218]
Java SE 8 Update 311 ^[219]	2021-10-19	New features, changes, 52 bug fixes. ^[220]
Java SE 8 Update 321 ^[221]	2022-01-18	New features, changes, 62 bug fixes. ^[222]
Java SE 8 Update 331 ^[223]	2022-04-19	New features, changes, 37 bug fixes. ^[224]
Java SE 8 Update 333 ^[225]	2022-05-02	Patch w/1 change and 2 bug fixes. ^[226]
Java SE 8 Update 341 ^[227]	2022-07-19	New features, changes, 42 bug fixes. ^[228]

Java SE 8 Update 351 ^[229]	2022-10-18	New features, changes, 95 bug fixes. ^[230]
Java SE 8 Update 361 ^[231]	2023-01-17	New features, changes, bug fixes.
Java SE 8 Update 371 (https://www.oracle.com/java/technologies/javase/8u371-releases.html)	2023-04-18	
Java SE 8 Update 381 ^[232]	2023-07-18	Security Patches

Java SE 9

Java SE 9 was made available on September 21, 2017^[233] due to controversial acceptance of the current implementation of Project Jigsaw by Java Executive Committee^[234] which led Oracle to fix some open issues and concerns and to refine some critical technical questions. In the last days of June 2017, Java Community Process expressed nearly unanimous consensus on the proposed Module System scheme.^[235]

Java SE 9

Released	September 21, 2017
# of JEPs	9
Support ended	
Public	March 2018

- JSR 376: Modularization of the JDK under Project Jigsaw (Java Platform Module System)^[106]
- JavaDB was removed from JDK^[236]
- JEP 193: Variable handles (<https://openjdk.java.net/jeps/193>), define a standard means to invoke the equivalents of various `java.util.concurrent.atomic` and `sun.misc.Unsafe` operations
- JEP 213: Milling Project Coin (<https://openjdk.java.net/jeps/213>), allow `@SafeVarargs` on private instance methods; Allow effectively-final variables to be used as resources in the try-with-resources statement; Allow diamond with anonymous classes if the argument type of the inferred type is denotable; Complete the removal, begun in Java SE 8, of underscore from the set of legal identifier names; Support for private methods in interfaces
- JEP 222: jshell: The Java Shell (Read-Eval-Print Loop) (<https://openjdk.java.net/jeps/222>): JShell is a REPL command-line interface for the Java language.^[237]
- JEP 254: Compact Strings (<https://openjdk.java.net/jeps/254>)
- JEP 263: HiDPI graphics: automatic scaling and sizing (<https://openjdk.java.net/jeps/263>)
- JEP 266: More concurrency updates (<https://openjdk.java.net/jeps/266>), it includes a Java implementation of Reactive Streams,^[238] including a new `Flow` class^[239] that included the interfaces previously provided by Reactive Streams^[240]
- JEP 268: XML catalogs (<https://openjdk.java.net/jeps/268>)
- JEP 282: jlink: The Java Linker (<https://openjdk.java.net/jeps/282>), create a tool that can assemble and optimize a set of modules and their dependencies into a custom run-time image. It effectively allows to produce a fully usable executable including the JVM to run it
- JEP 295: Ahead-of-Time Compilation (<https://openjdk.java.net/jeps/295>), ahead-of-time compilation provided by GraalVM

The first Java 9 release candidate was released on August 9, 2017.^[241] The first stable release of Java 9 was on September 21, 2017.^[242]

History

At JavaOne 2011, Oracle discussed features they hoped to release for Java 9 in 2016.^[243] Java 9 should include better support for multi-gigabyte heaps, better native code integration, a different default garbage collector (G1, for "shorter response times")^[244] and a self-tuning JVM.^[245] In early 2016, the release of Java 9 was rescheduled for March 2017^[246] and later again postponed four more months to July 2017.^[247]

Java 9 updates

Table of Java 9 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 9 ^[248]	2017-09-21	Initial release
Java SE 9.0.1 ^[249]	2017-10-17	New features ▪ Add Additional IDL Stub Type Checks to org.omg.CORBA.ORB::string_to_object Method (other-libs/corba) Known issues ▪ TLS does not work by default on OpenJDK 9 (security-libs/java.security) Changes ▪ Remove revoked Swisscom root certificate "swisscomrootevca2" (security-libs/java.security) ▪ Refactor existing providers to refer to the same constants for default values for key length (security-libs/java.security) ▪ Collections use serialization filter to limit array sizes (security-libs/java.security) ▪ Add warnings to keytool when using JKS and JCEKS (security-libs/java.security) Other notes ▪ Default timeouts have changed for FTP URL handler (core-libs/java.net) Bug fixes ▪ 12 bug fixes^[250]
Java SE 9.0.4 ^[251]	2018-01-16	New features ▪ Open source the root certificates in Oracle's Java SE Root CA program (security-libs/javax.net.ssl) ▪ Added TLS session hash and extended master secret extension support (security-libs/javax.net.ssl) ▪ Negotiated Finite Field Diffie-Hellman Ephemeral Parameters for TLS (security-libs/javax.net.ssl) ▪ Add additional IDL stub type checks to org.omg.CORBA.ORBstring_to_object method (other-libs/corba) Changes

- RSA public key validation (security-lib/javax.crypto)
- Provider default key size is updated (security-lib/avax.crypto)
- Stricter key generation (security-lib/avax.crypto)
- Disable exportable cipher suites (security-lib/avax.net.ssl)
- JMX Connections need deserialization filters (core-svc/avax.management)
- JDK Transform, Validation and XPath use the system-default parser (xml/jaxp)

Bug fixes

- JNLP files won't launch from IE11 on Windows 10 Creators Update (deploy/webstart)
- 11 bug fixes^[252]

Java SE 10

OpenJDK 10 was released on March 20, 2018, with twelve new features confirmed.^[253] Among these features were:

- JEP 286: Local-Variable Type Inference (<https://openjdk.java.net/jeps/286>)
- JEP 296: Consolidate the JDK Forest into a Single Repository (<https://openjdk.java.net/jeps/296>)
- JEP 304: Garbage-Collector Interface (<https://openjdk.java.net/jeps/304>)
- JEP 307: Parallel Full GC for G1 (<https://openjdk.java.net/jeps/307>)
- JEP 310: Application Class-Data Sharing (<https://openjdk.java.net/jeps/310>)
- JEP 312: Thread-Local Handshakes (<https://openjdk.java.net/jeps/312>)
- JEP 313: Remove the Native-Header Generation Tool (javah) (<https://openjdk.java.net/jeps/313>)
- JEP 314: Additional Unicode Language-Tag Extensions (<https://openjdk.java.net/jeps/314>)
- JEP 316: Heap Allocation on Alternative Memory Devices (<https://openjdk.java.net/jeps/316>)
- JEP 317: Experimental Java-Based JIT Compiler (<https://openjdk.java.net/jeps/317>)
- JEP 319: Root Certificates (<https://openjdk.java.net/jeps/319>)
- JEP 322: Time-Based Release Versioning (<https://openjdk.java.net/jeps/322>)

Java SE 10

Released	March 20, 2018
# of JEPs	12
Support ended	
Public	September 2018

The first of these JEP 286 *Local-Variable Type Inference*, allows the var keyword to be used for local variables with the actual type calculated by the compiler. So we can do:

```
var list = new ArrayList<String>(); // infers ArrayList<String>
var stream = list.stream();        // infers Stream<String>
```

Java 10 updates

Table of Java 10 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 10 ^[254]	2018-03-20	Initial release
Java SE 10.0.1 ^[255]	2018-04-17	New features - Enhanced KeyStore Mechanisms (security-libs/javax.crypto) Changes - XML Signatures Signed with EC Keys Less Than 224 Bits Disabled (security-libs/javax.xml.crypto) 3DES Cipher Suites Disabled (security-libs/javax.net.ssl) Other notes - CipherOutputStream Usage (security-libs/javax.crypto) Bug fixes 5 bug fixes^[256]
Java SE 10.0.2 ^[257]	2018-07-17	Changes - filterArguments runs multiple filters in the wrong order (core-libs/java.lang.invoke) - Improve LDAP support (core-libs/javax.naming) - Better stack walking (core-libs/java.io.serialization) Bug fixes - JVM Crash during G1 GC (hotspot/gc) 7 bug fixes^[258]

Java SE 11

JDK 11 was released on September 25, 2018 and the version is currently open for bug fixes. It offers LTS, or Long-Term Support. Among others, Java 11 includes a number of new features, such as:^[259]

- JEP 181: Nest-Based Access Control (<https://openjdk.java.net/jeps/181>)
- JEP 309: Dynamic Class-File Constants (<https://openjdk.java.net/jeps/309>)

Java SE 11

<i>LTS version</i>	
Released	September 25, 2018
# of JEPs	17
Removal(s)	

- [JEP 315: Improve Aarch64 Intrinsics \(https://openjdk.java.net/jeps/315\)](https://openjdk.java.net/jeps/315)
- [JEP 318: Epsilon: A No-Op Garbage Collector \(https://openjdk.java.net/jeps/318\)](https://openjdk.java.net/jeps/318)
- [JEP 320: Remove the Java EE and CORBA Modules \(https://openjdk.java.net/jeps/320\)](https://openjdk.java.net/jeps/320)
- [JEP 321: HTTP Client \(Standard\) \(https://openjdk.java.net/jeps/321\)](https://openjdk.java.net/jeps/321)
- [JEP 323: Local-Variable Syntax for Lambda Parameters \(https://openjdk.java.net/jeps/323\)](https://openjdk.java.net/jeps/323)
- [JEP 324: Key Agreement with Curve25519 and Curve448 \(https://openjdk.java.net/jeps/324\)](https://openjdk.java.net/jeps/324)
- [JEP 327: Unicode 10 \(https://openjdk.java.net/jeps/327\)](https://openjdk.java.net/jeps/327)
- [JEP 328: Flight Recorder \(https://openjdk.java.net/jeps/328\)](https://openjdk.java.net/jeps/328)
- [JEP 329: ChaCha20 and Poly1305 Cryptographic Algorithms \(https://openjdk.java.net/jeps/329\)](https://openjdk.java.net/jeps/329)
- [JEP 330: Launch Single-File Source-Code Programs \(https://openjdk.java.net/jeps/330\)](https://openjdk.java.net/jeps/330)
- [JEP 331: Low-Overhead Heap Profiling \(https://openjdk.java.net/jeps/331\)](https://openjdk.java.net/jeps/331)
- [JEP 332: Transport Layer Security \(TLS\) 1.3 \(https://openjdk.java.net/jeps/332\)](https://openjdk.java.net/jeps/332)
- [JEP 333: ZGC: A Scalable Low-Latency Garbage Collector \(Experimental\) \(https://openjdk.java.net/jeps/333\)](https://openjdk.java.net/jeps/333)
- [JEP 335: Deprecate the Nashorn JavaScript Engine \(https://openjdk.java.net/jeps/335\)](https://openjdk.java.net/jeps/335)
- [JEP 336: Deprecate the Pack200 Tools and API \(https://openjdk.java.net/jeps/336\)](https://openjdk.java.net/jeps/336)

Notable	Java applets , Java Web Start , JavaFX , JavaEE , and CORBA modules
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A number of features from previous releases were dropped; in particular, Java applets and Java Web Start are no longer available. JavaFX, Java EE and CORBA modules have been removed from JDK.^[260]

Java 11 updates

Table of Java 11 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 11 ^[261]	2018-09-25	Initial release
Java SE 11.0.1 ^[262]	2018-10-16	Changes ▪ Added Additional TeliaSonera Root Certificate (security-libs/java.security) ▪ Improve LDAP support (core-libs/javax.naming) ▪ Changed Central File System Location for usagetracker.properties File (core-svc) ▪ Problem looking up Client Certificates in keystore (security-libs/javax.net.ssl) ▪ Disabled All DES TLS Cipher Suites (security-libs/javax.net.ssl) ▪ Improved Cipher Inputs (security-libs/javax.crypto) Bug fixes ▪ LDAPS Communication Failure (core-libs/javax.naming) ▪ Better HTTP Redirection Support (core-libs/java.net) ▪ 5 bug fixes^[263]
Java SE 11.0.2 ^[264]	2019-01-15	Known issues ▪ GTK+ 3.20 and Later Unsupported by Swing (client-libs) Changes ▪ TLS anon and NULL Cipher Suites are Disabled (security-libs/javax.net.ssl) ▪ Linux Native Code Checks (hotspot/runtime) ▪ Enable Java Access Bridge Check Box Option in Control Panel Is Not Available with JDK 11 Installer (security-libs/javax.net.ssl) Bug fixes ▪ 59 bug fixes^[265]
Java SE 11.0.3 ^[266]	2019-04-16	New features ▪ Square Character Support for Japanese New Era (core-libs/java.util.i18n) Known issues ▪ Java Access Bridge Installation Workaround (install) Changes

		▪ Added GlobalSign R6 Root Certificate (security-libs/java.security) ▪ Distrust TLS Server Certificates Anchored by Symantec Root CAs (security-libs/javax.net.ssl) ▪ New Japanese Era Name Reiwa (core-libs/java.time) ▪ Support New Japanese Era in java.time.chrono.JapaneseEra (core-libs/java.time) Bug fixes ▪ 17 bug fixes^[267]
Java SE 11.0.4 ^[268]	2019-07-16	New features ▪ HotSpot Windows OS Detection Correctly Identifies Windows Server 2019 (hotspot/runtime) Removed features and options ▪ Removal of Two DocuSign Root CA Certificates (security-libs/java.security) ▪ Removal of Two Comodo Root CA Certificates (security-libs/java.security) ▪ Removal of T-Systems Deutsche Telekom Root CA 2 Certificate (security-libs/java.security) ▪ Removal of GTE CyberTrust Global Root (security-libs/java.security) Other notes ▪ com.sun.org.apache.xml.internal.security.ignoreLineBreaks System Property (security-libs/javax.xml.crypto) ▪ System Property to Switch Between Implementations of ECC (security-libs/javax.crypto) Bug fixes ▪ 42 bug fixes^[269]
Java SE 11.0.5 ^[270]	2019-10-15	New features ▪ New Java Flight Recorder (JFR) Security Events (security-libs/java.security) Other notes ▪ Using the JDK or JRE on macOS Catalina (10.15) (docs) ▪ Remove Obsolete NIST EC Curves from the Default TLS Algorithms (security-libs/javax.net.ssl) ▪ Use SunJCE Mac in SecretKeyFactory PBKDF2 Implementation (security-libs/javax.crypto) ▪ Java Access Bridge Installation Workaround (install) ▪ Updated XML Signature Implementation to Apache Santuario 2.1.3 (security-libs/javax.xml.crypto) ▪ System Property jdk.security.useLegacyECC is Turned Off by Default (security-libs/javax.crypto) ▪ Changed Properties.loadFromXML to Comply with Specification (core-libs/java.util) ▪ Runtime.exec and ProcessBuilder Argument Restrictions (core-libs/java.lang)

		- Windows 2019 Core Server Is Not Supported (client-libs/2d) Bug fixes 83 bug fixes^[271]
Java SE 11.0.6 ^[272]	2020-01-14	New features - Allow SASL Mechanisms to Be Restricted (security-libs/javax.security) - SunPKCS11 Provider Upgraded with Support for PKCS#11 v2.40 (security-libs/javax.crypto:pkcs11) Other notes - Improve Registry Support (core-libs/java.rmi) - New Checks on Trust Anchor Certificates (security-libs/java.security) - Exact Match Required for Trusted TLS Server Certificate (security-libs/java.security) - Added LuxTrust Global Root 2 Certificate (install/security-libs/java.security) - Added 4 Amazon Root CA Certificates (security-libs/java.security) - Turn off AOT by Default and Change Related Flags to Experimental (hotspot/compiler) - Epsilon GC handled checked array stores incorrectly (hotspot/gc) Bug fixes - Memory Growth Issue in SunPKCS11 Fixed (security-libs/javax.crypto:pkcs11) - Better Serial Filter Handling (core-libs/java.io:serialization) 123 bug fixes^[273]
Java SE 11.0.7 ^[274]	2020-04-14	New features - Support for MS Cryptography Next Generation (CNG) (security-libs/javax.crypto) Bug fixes 140 bug fixes^[275]
Java SE 11.0.8 ^[276]	2020-07-14	New features - New System Properties to Configure the TLS Signature Schemes (security-libs/javax.net.ssl) - Apache Santuario Library Updated to Version 2.1.4 (security-libs/javax.xml.crypto) - Toolchain Upgrade to Xcode 10.1 (infrastructure) - Oracle JDK Installer for Windows Provides Executables (javac, etc) in a Path Reachable From Any Command Prompt (install/install) Removed features and options - Removal of Comodo Root CA Certificate (security-libs/java.security) - Removal of DocuSign Root CA Certificate (security-libs/java.security) Other notes

		▪ Improved Serialization Handling (security-lib/javax.net.ssl) ▪ Better Listing of Arrays (security-lib/javax.net.ssl) ▪ Default SSL Engine Should Create in Server Role (security-lib/javax.net.sslc) ▪ OperatingSystemMXBean Methods Inside a Container Return Container Specific Data (core-svc/java.lang.management) ▪ Default SSL Session Cache Size Updated to 20480 (security-lib) ▪ Deprecated NSWindowStyleMaskTexturedBackground (client-lib/javax.swing) Bug fixes ▪ 167 bug fixes^[277]
Java SE 11.0.9 ^[278]	2020-10-20	New features ▪ Weak Named Curves in TLS, CertPath, and Signed JAR Disabled by Default (security-lib/java.security) ▪ Support for Kerberos Cross-Realm Referrals (RFC 6806) (security-lib/org.ietf.jgss:krb5) ▪ Improve Certificate Chain Handling (security-lib/javax.net.ssl) ▪ Tools Warn If Weak Algorithms Are Used (security-lib/java.security) ▪ Support for canonicalize in krb5.conf (security-lib/org.ietf.jgss:krb5) Other notes ▪ Added Property to Control LDAP Authentication Mechanisms Allowed to Authenticate Over Clear Connections (core-lib/javax.naming) ▪ Added 3 SSL Corporation Root CA Certificates (security-lib/java.security) ▪ Added Entrust Root Certification Authority - G4 certificate (security-lib/java.security) ▪ Localized Time Zone Name Inconsistency Between English and Other Locales (core-lib/java.util:i18n) ▪ Enhanced Support of Proxy Class (core-lib/java.io:serialization) Bug fixes ▪ 118 bug fixes^[279]
Java SE 11.0.10 ^[280]	2021-01-19	New features ▪ -groupname Option Added to keytool Key Pair Generation (security-lib/java.security) ▪ Support for certificate_authorities Extension (security-lib/javax.net.ssl) ▪ POSIX_SPAWN Option on Linux (core-lib/java.lang) ▪ Support for X25519 and X448 in TLS (security-lib/javax.net.ssl) ▪ jarsigner Preserves POSIX File Permission and symlink Attributes (security-lib/java.security) Other notes ▪ Oracle JDK11u for Solaris Now Requires harfbuzz to be Installed (client-lib/2d) ▪ JDK time-zone data upgraded to tzdata2020d (core-lib/java.time)

		- JDK time-zone data upgraded to tzdata2020c (core-libs/java.time) - US/Pacific-New Zone Name Removed as Part of tzdata2020b (core-libs/java.time) Bug fixes 118 bug fixes^[281]
Java SE 11.0.11 ^[282]	2021-04-20	New features - jdeps --print-module-deps Reports Transitive Dependences (tools) Other notes - New System and Security Properties to Control Reconstruction of Remote Objects by JDK's Built-in JNDI RMI and LDAP Implementations (core-libs/javax.naming) - Added 2 HARICA Root CA Certificates (security-libs/java.security) - Disable TLS 1.0 and 1.1 (security-libs/javax.net.ssl) - Modified the MS950 charset Encoder's Conversion Table (core-libs/java.nio.charsets) - Less Ambiguous Processing of ProcessBuilder Quotes on Windows > (core-libs/java.lang) Bug fixes 88 bug fixes^[283]
Java SE 11.0.12 ^[284]	2021-07-20	New features - Support cross-realm MSSFU (security-libs/org.ietf.jgss:krb5) - Customizing PKCS12 keystore Generation (security-libs/java.security) Removed features and options - Removed Root Certificates with 1024-bit Keys (security-libs/java.security) - Removed Telia Company's Sonera Class2 CA Certificate (security-libs/java.security) Other notes - Updated List of Capabilities Provided by JDK RPMs (install/install) - ADDLOCAL=ToolsFeature,SourceFeature Argument No Longer Needed For Windows JDK Installer (install/install) - Upgraded the Default PKCS12 Encryption and MAC Algorithms (security-libs/java.security) - Disable SHA-1 JARs (security-libs/java.security) - Improve Encoding of TLS Application-Layer Protocol Negotiation (ALPN) Values (security-libs/javax.net.ssl) - URL FTP Protocol Handler: IPv4 Address Validation in Passive Mode (core-libs/java.net) Bug fixes 106 bug fixes^[285]

Java SE 11.0.13 ^[286]	2021-10-19	New features - Context-specific Deserialization Filters (core-libs/java.io.serialization) Removed features and options - Removed IdenTrust Root Certificate (security-libs/java.security) - Remove the Experimental AOT and JIT Compiler in OracleJDK 11u (hotspot/compiler) Other notes - Release Doesn't Correctly Recognize Windows 11 (core-libs/java.lang) - Change to Package Names in Linux RPM/DEB Installers (install) - Updated the Default Enabled Cipher Suites Preference (security-libs/javax.net.ssl) - System Property to Control Reconstruction of Reference Address Objects by JDK's Built-in JNDI LDAP Implementation (core-libs/javax.naming) - Release Doesn't Correctly Recognize Windows Server 2022 (hotspot/runtime) - Updated keytool to Create AKID From SKID of Issuing Certificate as Specified by RFC 5280 (security-libs/java.security) - SunPKCS11 Initialization With NSS When External FIPS Modules Are in Security Modules Database (security-libs/javax.crypto:pkcs11) Bug fixes 93 bug fixes^[287]
Java SE 11.0.14 ^[288]	2022-01-18	New features - New SunPKCS11 Configuration Properties (security-libs/javax.crypto:pkcs11) - Configurable Extensions With System Properties (security-libs/javax.net.ssl) Removed features and options - Removed Google's GlobalSign Root Certificate (security-libs/java.security) Other notes - Zip File System Provider Throws ZipException When Entry Name Element Contains "." or ".." (core-libs/java.nio) - Update Timezone Data to 2021c (core-libs/java.time) - LDAP Channel Binding Support for Java GSS/Kerberos (core-libs/javax.naming) - SocketExceptions Are Not Wrapped Into SSLExceptions in SSLSocketImpl (security-libs/javax.net.ssl) - OperatingSystemMXBean.getProcessCpuLoad Is Now Container Aware (hotspot/runtime) Bug fixes

		71 bug fixes^[289]
Java SE 11.0.15 ^[290]	2022-04-19	New features - SunPKCS11 Provider Supports ChaCha20-Poly1305 Cipher and ChaCha20 KeyGenerator if Supported by PKCS11 Library (security-libraries/java.security) - ChaCha20 and Poly1305 TLS Cipher Suites (security-libraries/java.net.ssl) - New XML Processing Limits (xml/jaxp) Other notes - Only Expose Certificates With Proper Trust Settings as Trusted Certificate Entries in macOS KeychainStore (security-libraries/java.security) - Parsing of URL Strings in Built-in JNDI Providers Is More Strict (core-libraries/java.naming) Bug fixes 81 bug fixes^[291]
Java SE 11.0.16 ^[292]	2022-07-19	New features - HTTPS Channel Binding Support for Java GSS/Kerberos (core-libraries/java.net) Other notes - Update java.net.InetAddress to Detect Ambiguous IPv4 Address Literals (core-libraries/java.net) - JDK Bundle Extensions Truncated When Downloading Using Firefox 102 (core-libraries/java.io.serialization) - Vector Should Throw ClassNotFoundException for a Missing Class of an Element (core-libraries/java.io.serialization) - Default JDK Compressor Will Be Closed when IOException Is Encountered (core-libraries/java.util.jar) Bug fixes 74 bug fixes^[293]
Java SE 11.0.16.1 ^[294]	2022-08-18	Changes C2 Compilation Errors Unpredictably Crashes JVM (hotspot/compiler)
Java SE 11.0.17 ^[295]	2022-10-18	New features - Upgrade the Default PKCS12 MAC Algorithm (security-libraries/java.security) - JDK Flight Recorder Event for Deserialization (core-libraries/java.io.serialization) Other notes - Disabled SHA-1 Signed JARs (security-libraries/java.security) - Deprecate 3DES and RC4 in Kerberos (security-libraries/org.ietf.jgss:krb5) - Make HttpURLConnection Default Keep Alive Timeout Configurable (core-libraries/java.net)

		▪ CPU Shares Ignored When Computing Active Processor Count (hotspot/runtime) ▪ Update Timezone Data to 2022c (core-libs/java.time) ▪ New System Property to Limit the Number of Open Connections to com.sun.net.httpserver.HttpServer (core-libs/java.net) Bug fixes ▪ 118 bug fixes^[296]
Java SE 11.0.18 ^[297]	2023-01-17	New features ▪ DTLS Resumption Uses HelloVerifyRequest Messages (security-libs/javax.net.ssl) ▪ Support for RSASSA-PSS in OCSP Response (security-libs/java.security) Known issues ▪ Installation of Oracle Linux Specific x64 JDK RPMs Pulls in i686 Dependencies (install/install) Other notes ▪ FXML JavaScript Engine Disabled by Default (javafx/fxml) ▪ Translated resource bundles for German (globalization) ▪ RPM JDK Installer Changes (install/install) ▪ Disable Side-by-Side Installations of Multiple JDK Updates in Windows JDK Installers (install/install) ▪ All JDK Update Releases Are Installed Into the Same Directory on macOS (install/install) ▪ Incorrect Handling of Quoted Arguments in ProcessBuilder (core-libs/java.lang) ▪ New Implementation Note for LoginModule on Removing Null from a Principals or Credentials set (security-libs/javax.security) ▪ Toolchain Upgrade to Visual Studio 2022 (infrastructure) ▪ Change in SSLEngine.closeInbound() Behavior (security-libs/javax.net.ssl) Bug fixes ▪ 58 bug fixes^[298]
Java SE 11.0.19 ^[299]	2023-04-18	New features ▪ Added a Default Native GSS-API Library on Windows (security-libs/org.ietf.jgss) Other notes ▪ System Property to Handle HTML ObjectView Creation (client-libs/javax.swing) ▪ Added Certigna(Dhimyotis) Root CA Certificate (security-libs/java.security) ▪ Removed SSLv2Hello and SSLv3 From Default Enabled TLS Protocols (security-libs/javax.net.ssl)

		- File::listRoots Changed to Return All Available Drives on Windows (core-lib/java.io) - Crypto-J Exception for Diffie-Hellman and DSA AlgorithmParameters Requests (security-lib/java.security) Bug fixes 55 bug fixes^[300]
Java SE 11.0.20 ^[301]	2023-07-18	New features - Allow Additional Characters for GB18030-2022 Support (core-lib/java.lang) - Support for GB18030-2022 (core-lib/java.nio.charsets) - Update the Javadoc in the Character Class to State Support for GB 18030-2022 Implementation Level 2 (core-lib/java.lang) - Windows KeyStore Updated to Include Access to the Local Machine Location (security-lib/java.security) - New JFR Event: jdk.InitialSecurityProperty (security-lib/java.security) - New JFR Event: jdk.SecurityProviderService (security-lib/java.security) - JDK Now Accepts RSA Keys in PKCS#1 Format (security-lib/javax.crypto) Known issues - Problem Upgrading JDK on Windows if System User Is Using Shared Files (install) Other notes - System Property to Turn off JDK-8251329 Restrictions (core-lib/java.nio) - Missing /usr/java/default Symlink on Linux Restored (install/install) - Installation of JDK RPM Corrupts Alternatives (install/install) - Added TWCA Root CA Certificate (security-lib/java.security) - Added 4 GTS Root CA Certificates (security-lib/java.security) - Added Microsoft Corporation's 2 TLS Root CA Certificates (security-lib/java.security) - System Property for Java SE Specification Maintenance Version (core-lib/java.lang) - GregorianCalendar.computeTime() JVM Crash (hotspot/compiler) - ASLR Support for CDS Archive (hotspot/runtime) - Throw Error If Default java.security File Fails to Load (security-lib/java.security) - New System Property to Control the Maximum Size of Signature Files (security-lib/java.security) - Improved ZIP64 Extra Field Validation (core-lib/java.util.jar) Bug fixes 43 bug fixes^[302]
Java SE 11.0.21 ^[303]	2023-10-17	New features -XshowSettings:locale Output Now Includes Tzdata Version (tools/launcher)

	Removed features and options - Removed SECOM Trust System's RootCA1 Root Certificate (security-libs/java.security) Other notes - Added Certigna Root CA Certificate (security-libs/java.security) - Debian JDK Installer Changes (install/install) - Ignore Allow and Disallow Options for java.security.manager System Property (security-libs/java.security) - The Default TLS Diffie Hellman Group Size Has Been Increased from 1024-bit to 2048-bit (security-libs/javax.net.ssl) - Use Server Cipher Suites Preference by Default (security-libs/javax.net.ssl) Bug fixes 29 bug fixes^[304]
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Java SE 12

JDK 12 was released on March 19, 2019. Among others, Java 12 includes a number of new features, such as:^[305]

- JEP 189: Shenandoah: A Low-Pause-Time Garbage Collector (Experimental) (<https://openjdk.java.net/jeps/189>)
- JEP 230: Microbenchmark Suite (<https://openjdk.java.net/jeps/230>)
- JEP 325: Switch Expressions (Preview) (<https://openjdk.java.net/jeps/325>)
- JEP 334: JVM Constants API (<https://openjdk.java.net/jeps/334>)
- JEP 340: One AArch64 Port, Not Two (<https://openjdk.java.net/jeps/340>)
- JEP 341: Default CDS Archives (<https://openjdk.java.net/jeps/341>)
- JEP 344: Abortable Mixed Collections for G1 (<https://openjdk.java.net/jeps/344>)
- JEP 346: Promptly Return Unused Committed Memory from G1 (<https://openjdk.java.net/jeps/346>)

The preview feature JEP 325 extends the `switch` statement so it can also be used as an expression, and adds a new form of case label where the right hand side is an expression. No `break` statement is needed. For complex expressions a `yield` statement can be used. This becomes standard in Java SE 14.

```
int ndays = switch(month) {
    case JAN, MAR, MAY, JUL, AUG, OCT, DEC -> 31;
    case APR, JUN, SEP, NOV -> 30;
    case FEB -> {
        if (year % 400 == 0) yield 29;
        else if (year % 100 == 0) yield 28;
        else if (year % 4 == 0) yield 29;
    }
}
```

Java SE 12	
Released	March 19, 2019
# of JEPs	8
Addition(s)	
Preview(s)	Enhanced <code>switch</code> statements
Support ended	
Public	September 2019

```
};
else yield 28; }
```

Java 12 updates

Table of Java 12 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 12 ^[306]	2019-03-19	Initial release
Java SE 12.0.1 ^[307]	2019-04-16	Known issues - Java Access Bridge Installation Workaround (install) Changes - Added GlobalSign R6 Root Certificate (security-libs/java.security) - New Japanese Era Name Reiwa (core-libs/java.time) Bug fixes 3 bug fixes^[308]
Java SE 12.0.2 ^[309]	2019-07-16	Removed features and options - Removal of Two DocuSign Root CA Certificates (security-libs/java.security) - Removal of Two Comodo Root CA Certificate (security-libs/java.security) - Removal of T-Systems Deutsche Telekom Root CA 2 Certificate (security-libs/java.security) Other notes - Java Access Bridge Installation Workaround (install)

Java SE 13

JDK 13 was released on September 17, 2019. Java 13 includes the following new features, as well as "hundreds of smaller enhancements and thousands of bug fixes".^[311]

- JEP 350: Dynamic CDS Archives (<https://openjdk.java.net/jeps/350>)
- JEP 351: ZGC: Uncommit Unused Memory (<https://openjdk.java.net/jeps/351>)
- JEP 353: Reimplement the Legacy Socket API (<https://openjdk.java.net/jeps/353>)
- JEP 354: Switch Expressions (Preview) (<https://openjdk.java.net/jeps/354>)
- JEP 355: Text Blocks (Preview) (<https://openjdk.java.net/jeps/355>)

Java SE 13

Released	September 17, 2019
# of JEPs	5
Addition(s)	
Preview(s)	Enhanced <u>switch</u> statements, text blocks
Support ended	
Public	March 2023 ^[310]

JEP 355 *Text Blocks* allows multiline string literals:

```
String html = """
    <html lang="en">
      <body>
        <p>Hello, world</p>
      </body>
    </html>
    """;
```

Java 13 updates

Table of Java 13 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 13 ^[312]	2019-09-17	Initial release
Java SE 13.0.1 ^[313]	2019-10-15	Other notes ■ Using the JDK or JRE on macOS Catalina (10.15) (docs) ■ Remove Obsolete NIST EC Curves from the Default TLS Algorithm (security-libs/javax.net.ssl) ■ Text Visibility Issues in macOS Dark Mode (client-libs) ■ Runtime.exec and ProcessBuilder Argument Restrictions (core-libs/java.lang)
Java SE 13.0.2 ^[314]	2020-01-14	Other notes ■ New Checks on Trust Anchor Certificates (security-libs/java.security) ■ Exact Match Required for Trusted TLS Server Certificate (security-libs/java.security) ■ Added LuxTrust Global Root 2 Certificate (security-libs/java.security) ■ Added 4 Amazon Root CA Certificates (security-libs/java.security) ■ Improve Registry Support (core-libs/java.rmi) Bug fixes ■ Better Serial Filter Handling (core-libs/java.io.serialization) ■ 29 bug fixes^[315]

Java SE 14

JDK 14 was released on March 17, 2020. Java 14 includes the following new features, as well as "hundreds of smaller enhancements and thousands of bug fixes".^[316]

- JEP 305: Pattern Matching for instanceof (Preview) (<https://openjdk.java.net/jeps/305>)
- JEP 343: Packaging Tool (Incubator) (<https://openjdk.java.net/jeps/343>)
- JEP 345: NUMA-Aware Memory Allocation for G1 (<https://openjdk.java.net/jeps/345>)

Java SE 14

Released	March 17, 2020
# of JEPs	16
Addition(s)	
Notable	Helpful NullPointerExceptions , enhanced switch statements

- JEP 349: JFR Event Streaming (<https://openjdk.java.net/jeps/349>)
- JEP 352: Non-Volatile Mapped Byte Buffers (<https://openjdk.java.net/jeps/352>)
- JEP 358: Helpful NullPointerExceptions (<https://openjdk.java.net/jeps/358>)
- JEP 359: Records (Preview) (<https://openjdk.java.net/jeps/359>)
- JEP 361: Switch Expressions (Standard) (<https://openjdk.java.net/jeps/361>)
- JEP 362: Deprecate the Solaris and SPARC Ports (<https://openjdk.java.net/jeps/362>)
- JEP 363: Remove the Concurrent Mark Sweep (CMS) Garbage Collector (<https://openjdk.java.net/jeps/363>)
- JEP 364: ZGC on macOS (<https://openjdk.java.net/jeps/364>)
- JEP 365: ZGC on Windows (<https://openjdk.java.net/jeps/365>)
- JEP 366: Deprecate the ParallelScavenge + SerialOld GC Combination (<https://openjdk.java.net/jeps/366>)
- JEP 367: Remove the Pack200 Tools and API (<https://openjdk.java.net/jeps/367>)
- JEP 368: Text Blocks (Second Preview) (<https://openjdk.java.net/jeps/368>)
- JEP 370: Foreign-Memory Access API (Incubator) (<https://openjdk.java.net/jeps/370>)

Preview(s)	<u>Pattern matching for instanceof</u> , <u>records</u> , text blocks
Incubating	jpackager, Foreign memory access
Removal(s)	
Notable	Remove Concurrent Mark Sweep <u>garbage collector</u>
Support ended	
Public	September 2020

JEP 305, *Pattern Matching for instanceof* simplifies the common case of an instanceof test being immediately followed by cast, replacing

```
if (obj instanceof String) {
    String s = (String) obj;
    System.out.println( s.length() );
}
```

with

```
if (obj instanceof String s) {
    System.out.println( s.length() );
}
```

JEP 359 *Records* allows easy creation of simple immutable Tuple-like classes.^[317]

```
record Point(int x, int y) { }
Point p = new Point(3,4);
System.out.println( p.x() );
```

Java 14 updates

Table of Java 14 update [[how](#)]

Release	Release date	Highlights
Java SE 14 ^[318]	2020-03-17	Initial release
Java SE 14.0.1 ^[319]	2020-04-14	Bug fixes 2 bug fixes^[320]
Java SE 14.0.2 ^[321]	2020-07-14	Removed features and options - Removal of Comodo Root CA Certificate (security-libs/java.security) - Removal of DocuSign Root CA Certificate (security-libs/java.security) Other notes - Better Listing of Arrays (core-libs/java.util.collections) - Default SSLEngine Should Create in Server Role (security-libs/javax.net.ssl) - Improved Serialization Handling (core-libs/java.io.serialization) Bug fixes 8 bug fixes^[322]

Java SE 15

JDK 15 was released on September 15, 2020. Java 15 adds e.g. support for multi-line string literals (aka Text Blocks). The Shenandoah and Z garbage collectors (latter sometimes abbreviated ZGC) are now ready for use in production (i.e. no longer marked experimental). Support for Oracle's Solaris operating system (and SPARC CPUs) is dropped (while still available in e.g. Java 11). The Nashorn JavaScript Engine is removed. Also removed some root CA certificates.

- JEP 339: Edwards-Curve Digital Signature Algorithm (EdDSA) (<https://openjdk.java.net/jeps/339>)
- JEP 360: Sealed Classes (Preview) (<https://openjdk.java.net/jeps/360>)
- JEP 371: Hidden Classes (<https://openjdk.java.net/jeps/371>)
- JEP 372: Remove the Nashorn JavaScript Engine (<https://openjdk.java.net/jeps/372>)
- JEP 373: Reimplement the Legacy DatagramSocket API (<https://openjdk.java.net/jeps/373>)

Java SE 15

Released	September 15, 2020
# of JEPs	14
Addition(s)	
Notable	Hidden classes, ZGC (garbage collector), Shenandoah (garbage collector), text block
Preview(s)	Sealed classes, pattern matching of in tanceof, records
Incubating	Foreign-memory acce
Removal(s)	

- JEP 374: Disable and Deprecate Biased Locking (<https://openjdk.java.net/jeps/374>)
- JEP 375: Pattern Matching for instanceof (Second Preview) (<https://openjdk.java.net/jeps/375>)
- JEP 377: ZGC: A Scalable Low-Latency Garbage Collector (<https://openjdk.java.net/jeps/377>)
- JEP 378: Text Blocks (<https://openjdk.java.net/jeps/378>)
- JEP 379: Shenandoah: A Low Pause Time Garbage Collector (<https://openjdk.java.net/jeps/379>)
- JEP 381: Remove the Solaris and SPARC Ports (<https://openjdk.java.net/jeps/381>)
- JEP 383: Foreign Memory Access API (Second Incubator) (<https://openjdk.java.net/jeps/383>)
- JEP 384: Records (Second Preview) (<https://openjdk.java.net/jeps/384>)
- JEP 385: Deprecate RMI Activation for Removal (<https://openjdk.java.net/jeps/385>)

Notable	JavaScript engine, Solaris and SPARC ports
Support ended	
Public	March 2023 ^[310]

JEP 360 *Sealed Classes* adds sealed classes and interfaces that restrict which other classes or interfaces may extend or implement them. Only those classes specified in a `permits` clause may extend the class or interface.

```
package com.example.geometry;

public abstract sealed class Shape
    permits Circle, Rectangle, Square {...}
```

Together with records, sealed classes are sum types. They work well with other recent features like records, switch expressions, and pattern matching for instance of. They all form part of a system for "Pattern matching in Java" first discussed by Gavin Bierman and Brian Goetz, in September 2018.^[323]

Java 15 updates

Table of Java 15 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 15 ^[324]	2020-09-15	Initial release
Java SE 15.0.1 ^[325]	2020-10-20	New features - Improve Certificate Chain Handling (security libs/javax net ssl) Other notes - Added Property to Control LDAP Authentication Mechanisms Allowed to Authenticate Over Clear Connections (core-libs/javax naming) - Added 3 SSL Corporation Root CA Certificates (security-libs/java.security) - Added Entrust Root Certification Authority - G4 certificate (security libs/java security) - Enhanced Support of Proxy Class (core-libs/java.io.serialization) Bug fixes 8 bug fixes^[326]
Java SE 15.0.2 ^[327]	2021-01-19	Other notes - JDK time zone data upgraded to tzdata2020d (core libs/java time) - JDK time-zone data upgraded to tzdata2020c (core-libs/java.time) - US/Pacific-New Zone Name Removed as Part of tzdata2020b (core-libs/java.time) Bug fixes 24 bug fixes^[328]

Java SE 16

JDK 16 was released on March 16, 2021. Java 16 removes Ahead-of-Time compilation (and Graal JIT) options.^[3 9] The Java implementation itself was and is still written in C++, while as of Java 16, more recent C++14 (but still not e.g. C++17 or C++20) is allowed. The code was also moved to GitHub, dropping Mercurial as the source control system.

Java SE 16

Released	March 16, 2021
# of JEPs	17
Addition(s)	
Notable	Windows/AArch64 Port, jpackager, <u>pattern</u>

- [JEP 338: Vector API \(Incubator\) \(https://openjdk.java.net/jeps/338\)](https://openjdk.java.net/jeps/338)
- [JEP 347: Enable C++14 Language Features \(https://openjdk.java.net/jeps/347\)](https://openjdk.java.net/jeps/347)
- [JEP 357: Migrate from Mercurial to Git \(https://openjdk.java.net/jeps/357\)](https://openjdk.java.net/jeps/357)
- [JEP 369: Migrate to GitHub \(https://openjdk.java.net/jeps/369\)](https://openjdk.java.net/jeps/369)
- [JEP 376 ZGC Concurrent Thread Stack Processing \(https // openjdk.java.net/jeps/376\)](https://openjdk.java.net/jeps/376)
- [JEP 380 Unix Domain Socket Channels \(https //openjdk java net/jeps/380\)](https://openjdk.java.net/jeps/380)
- [JEP 386: Alpine Linux Port \(https://openjdk.java.net/jeps/386\)](https://openjdk.java.net/jeps/386) – not yet stable
- [JEP 387 Elastic Metaspace \(https //openjdk java net/jeps/387\)](https://openjdk.java.net/jeps/387)
- [JEP 388: Windows/AArch64 Port \(https://openjdk.java.net/jeps/388\)](https://openjdk.java.net/jeps/388)
- [JEP 389 Foreign Linker API \(Incubator\) \(https //openjdk java net/jeps/389\)](https://openjdk.java.net/jeps/389)
- [JEP 390: Warnings for Value-Based Classes \(https://openjdk.java.net/jeps/390\)](https://openjdk.java.net/jeps/390)
- [JEP 392 Packaging Tool \(https //openjdk java net/jeps/392\)](https://openjdk.java.net/jeps/392)
- [JEP 393: Foreign-Memory Access API \(Third Incubator\) \(https://openjdk.java.net/jeps/393\)](https://openjdk.java.net/jeps/393)
- [JEP 394 Pattern Matching for instanceof \(https //openjdk java net/jeps/394\)](https://openjdk.java.net/jeps/394)
- [JEP 395: Records \(https://openjdk.java.net/jeps/395\)](https://openjdk.java.net/jeps/395)
- [JEP 396 Strongly Encapsulate JDK Internals by Default \(https //openjdk java net/jeps/396\)](https://openjdk.java.net/jeps/396)

	matching for instanceof, records
Preview(s)	Sealed class
Incubating	Foreign linker , Foreign-memory access
Support ended	
Public	September 2021

- [JEP 397: Sealed Classes \(Second Preview\) \(https://openjdk.java.net/jeps/397\)](https://openjdk.java.net/jeps/397)

Java 16 updates

Table of Java 16 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 16 ^[330]	2021-03-16	Initial release
Java SE 16.0.1 ^[331]	2021-04-20	Other notes ■ New System and Security Properties to Control Reconstruction of Remote Objects by JDK's Built-in JNDI RMI and LDAP Implementations (core-libs/javax.naming) ■ Added 2 HARICA Root CA Certificates (security-libs/java.security) ■ Less Ambiguous Processing of Process Builder Quote on Windows (core-libs/java.lang) Bug fixes ■ 30 bug fixes^[332]
Java SE 16.0.2 ^[333]	2021-07-20	Removed features and options ■ Removed Telia Company's Sonera Class2 CA certificate (security-libs/java.security) Other notes ■ Updated List of Capabilities Provided by JDK RPMs (install/install) ■ Change to Package Name in Linux RPM/DEB Installer (install/install) ■ URL FTP Protocol Handler: IPv4 Address Validation in Passive Mode (core-libs/java.net) ■ SocketException Are Not Wrapped Into SSLException in SSLSocketImpl (security-libs/javax.net.ssl) ■ Disable SHA-1 JARs (security-libs/java.security) Bug fixes ■ 25 bug fixes^[334]

Java SE 17

JDK 17 was released in September 2021.^[335] Java 17 is the 2nd long-term support (LTS) release since switching to the new 6-month release cadence (the first being Java 11).

- [JEP 306: Restore Always-Strict Floating-Point Semantics \(https://openjdk.java.net/jeps/306\)](https://openjdk.java.net/jeps/306)
- [JEP 356: Enhanced Pseudo-Random Number Generators \(https://openjdk.java.net/jeps/356\)](https://openjdk.java.net/jeps/356)

Java SE 17

LTS version	
Released	September 14, 2021
# of JEPs	14
Addition(s)	
Notable	macOS/AArch64 Port,

- [JEP 382: New macOS Rendering Pipeline](https://openjdk.java.net/jeps/382) (<https://openjdk.java.net/jeps/382>)
- [JEP 391: macOS/AArch64 Port](https://openjdk.java.net/jeps/391) (<https://openjdk.java.net/jeps/391>)
- [JEP 398: Deprecate the Applet API for Removal](https://openjdk.java.net/jeps/398) (<https://openjdk.java.net/jeps/398>)
- [JEP 403: Strongly Encapsulate JDK Internals](https://openjdk.java.net/jeps/403) (<https://openjdk.java.net/jeps/403>)
- [JEP 406: Pattern Matching for switch \(Preview\)](https://openjdk.java.net/jeps/406) (<https://openjdk.java.net/jeps/406>)
- [JEP 407: Remove RMI Activation](https://openjdk.java.net/jeps/407) (<https://openjdk.java.net/jeps/407>)
- [JEP 409: Sealed Classes](https://openjdk.java.net/jeps/409) (<https://openjdk.java.net/jeps/409>)
- [JEP 410: Remove the Experimental AOT and JIT Compiler](https://openjdk.java.net/jeps/410) (<https://openjdk.java.net/jeps/410>)
- [JEP 411: Deprecate the Security Manager for Removal](https://openjdk.java.net/jeps/411) (<https://openjdk.java.net/jeps/411>)
- [JEP 412: Foreign Function & Memory API \(Incubator\)](https://openjdk.java.net/jeps/412) (<https://openjdk.java.net/jeps/412>)
- [JEP 414: Vector API \(Second Incubator\)](https://openjdk.java.net/jeps/414) (<https://openjdk.java.net/jeps/414>)
- [JEP 415: Context Specific Deserialization Filters](https://openjdk.java.net/jeps/415) (<https://openjdk.java.net/jeps/415>)

	<u>sealed classes</u>
Preview(s)	<u>Switch pattern matching</u>
Incubating	Vector API, Foreign function & memory API
	Removal(s)
Notable	<u>AOT compiler</u> , <u>RMI activation</u> , <u>strictfp</u> keyword made obsolete (PEP 306)

JEP 406 extends the pattern matching syntax used in instanceof operations to switch statements and expressions. It allows cases to be selected based on the type of the argument, null cases and refining patterns

```
Object o = ...;
return switch (o) {
    case null      -> "Null";
    case String s   -> String.format("String %s", s);
    case Long l     -> String.format("long %d", l);
    case Double d   -> String.format("double %f", d);
    case Integer i && i > 0 // refining patterns
                    -> String.format("positive int %d", i);
    case Integer i && i == 0
                    -> String.format("zero int %d", i);
    case Integer i && i < 0
                    -> String.format("negative int %d", i);
    default        -> o.toString();
}
```

```
};
```

Java 17 updates

Table of Java 17 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 17 ^[336]	2021-09-14	Initial release
Java SE 17.0.1 ^[337]	2021-10-19	Removed features and options - Removed IdenTru t Root Certificate (security libs/java security) Other notes - Release Doesn't Correctly Recognize Windows 11 (core-libs/java.lang) - System Property to Control Reconstruction of Reference Address Object by JDK's Built in JNDI LDAP Implementation (core-libs/javax.naming) - Release Doesn't Correctly Recognize Windows Server 2022 (hotspot/runtime) - OperatingSystemMBean getProcessCpuLoad() Now Container Aware (hotspot/runtime) Bug fixes 21 bug fixes^[338]
Java SE 17.0.2 ^[339]	2022-01-18	Removed features and options - Removed Google's GlobalSign Root Certificate (security-libs/java.security) Other notes - Extended Delay Before JDK Executable Installer Start From Network Drive (install/install) - file.encoding System Property Has an Incorrect Value on Windows (core-libs/java.io) - Zip File System Provider Throw ZipException When Entry Name Element Contains "." or ".." (core-libs/java.nio) - Update Timezone Data to 2021c (core-libs/java.time) - ZGC: Fixed long Process Non-Strong References times (hotspot/gc) Bug fixes 164 bug fixes^[340]
Java SE 17.0.3 ^[341]	2022-04-19	New features New XML Processing Limit (xml/jaxp) Other notes

		▪ Only E po e Certificate With Proper Tru t Setting a Tru ted Certificate Entries in macOS KeychainStore (security-libs/java.security) ▪ Parsing of URL Strings in Built-in JNDI Providers Is More Strict (core-libs/javax.naming) Bug fixes ▪ 48 bug fixes^[342]
Java SE 17.0.3.1 ^[343]	2022-05-02	Changes ▪ New System Property to Disable Windows Alternate Data Stream Support in java.io.File (core-libs/java.io) Bug fixes ▪ 2 bug fixes^[344]
Java SE 17.0.4 ^[345]	2022-07-19	New features ▪ HTTPS Channel Binding Support for Java GSS/Kerberos (core-libs/java.net) Other notes ▪ Update java.net.InetAddress to Detect Ambiguous IPv4 Address Literals (core-libs/java.net) ▪ Default JDK Compressor Will Be Closed when IOException Is Encountered (core-libs/java.util.jar) ▪ CPU Shares Ignored When Computing Active Processor Count (hotspot/runtime) Bug fixes ▪ 60 bug fixes^[346]
Java SE 17.0.4.1 ^[347]	2022-08-18	Changes ▪ C2 Compilation Errors Unpredictably Crashes JVM (hotspot/compiler)
Java SE 17.0.5 ^[348]	2022-10-18	New features ▪ HTTPS Channel Binding Support for Java GSS/Kerberos (core-libs/java.net) Other notes ▪ Update java.net.InetAddress to Detect Ambiguous IPv4 Address Literal (core-libs/java.net) ▪ Default JDK Compressor Will Be Closed when IOException Is Encountered (core-libs/java.util.jar) ▪ CPU Shares Ignored When Computing Active Processor Count (hotspot/runtime) Bug fixes ▪ 77 bug fixes^[349]
Java SE 17.0.6 ^[350]	2023-01-17	New features

		■ DTLS Resumption Uses HelloVerifyRequest Messages (security-libs/javax.net.ssl) ■ Support for RSASSA-PSS in OCSP Response (security-libs/java.security) Known issues ■ Installation of Oracle Linux Specific x64 JDK RPMs Pulls in i686 Dependencie (install/install) Other notes ■ FXML JavaScript Engine Disabled by Default (javafx/fxml) ■ Translated resource bundles for German (globalization) ■ RPM JDK In taller Change (install/install) ■ Disable Side-by-Side Installations of Multiple JDK Updates in Windows JDK Installers (install/install) ■ All JDK Update Releases Are Installed Into the Same Directory on macOS (install/install) ■ Incorrect Handling of Quoted Arguments in ProcessBuilder (core-libs/java.lang) ■ New Implementation Note for LoginModule on Removing Null from a Principal or Credential et (security-libs/javax.security) ■ Toolchain Upgrade to Visual Studio 2022 (infrastructure) ■ Change in SSLEngine.closeInbound() Behavior (security-libs/javax.net.ssl) Bug fixes ■ 52 bug fixes^[351]
Java SE 17.0.7 ^[352]	2023-04-18	New features ■ New JFR Event: jdk.InitialSecurityProperty (security-libs/java.security) Other notes ■ System Property to Handle HTML ObjectView Creation (client-libs/javax.swing) ■ Added Certigna(Dhimyotis) CA Certificate (security-libs/java.security) ■ File::listRoots Changed to Return All Available Drives on Windows (core-libs/java.io) ■ Throw Error If Default java ecurity File Fail to Load (security-libs/java.security) ■ Crypto-J Exception for Diffie-Hellman and DSA AlgorithmParameters Requests (security-libs/java.security) Bug fixes ■ 69 bug fixes^[353]
Java SE 17.0.8 ^[354]	2023-07-18	New features ■ Support for GB18030-2022 (core-libs/java.nio.charsets) ■ Window KeyStore Updated to Include Acce to the Local Machine Location (security-libs/java.security)

		▪ New JFR Event <code>jdk.SecurityProviderService</code> (<code>security-libs/java.security</code>) Known issues ▪ Problem Upgrading JDK on Windows if System User Is Using Shared File (<code>install</code>) Other notes ▪ System Property to Turn off JDK-8251329 Restrictions (<code>core-libs/java.nio</code>) ▪ Debian JDK In taller Change (<code>install/install</code>) ▪ Missing <code>/usr/java/default</code> Symlink on Linux Restored (<code>install/install</code>) ▪ Installation of JDK RPM Corrupts Alternatives (<code>install/install</code>) ▪ Added TWCA Root CA Certificate (<code>security-libs/java.security</code>) ▪ Added 4 GTS Root CA Certificate (<code>security-libs/java.security</code>) ▪ Added Microsoft Corporation's 2 TLS Root CA Certificates (<code>security-libs/java.security</code>) ▪ <code>GregorianCalendar.computeTime()</code> JVM Crash (<code>hotspot/compiler</code>) ▪ ASLR Support for CDS Archive (<code>hotspot/runtime</code>) ▪ New System Property to Control the Maximum Size of Signature Files (<code>security-libs/java.security</code>) ▪ Improved ZIP64 Extra Field Validation (<code>core-libs/java.util.jar</code>) Bug fixes ▪ 56 bug fixes^[355]
Java SE 17.0.9 ^[356]	2023 10 17	New features ▪ <code>-XshowSettings:locale</code> Output Now Includes Tzdata Version (<code>tools/launcher</code>) Removed features and options ▪ Removed SECOM Trust System's RootCA1 Root Certificate (<code>security-libs/java.security</code>) Other notes ▪ Added Certigna Root CA Certificate (<code>security-libs/java.security</code>) ▪ The Default TLS Diffie-Hellman Group Size Has Been Increased from 1024-bit to 2048-bit (<code>security-libs/javax.net.ssl</code>) Bug fixes ▪ 56 bug fixes^[357]

Java SE 18

JDK 18 was released on March 22, 2022.^[358]

Java version history

- [JEP 400: UTF-8 by Default \(https://openjdk.java.net/jeps/400\)](https://openjdk.java.net/jeps/400)
- [JEP 408 Simple Web Server \(https://openjdk.java.net/jeps/408\)](https://openjdk.java.net/jeps/408)
- [JEP 413 Code Snippets in Java API Documentation \(https://openjdk.java.net/jeps/413\)](https://openjdk.java.net/jeps/413)
- [JEP 416 Reimplement Core Reflection with Method Handles \(https://openjdk.java.net/jeps/416\)](https://openjdk.java.net/jeps/416)
- [JEP 417 Vector API \(Third Incubator\) \(https://openjdk.java.net/jeps/417\)](https://openjdk.java.net/jeps/417)
- [JEP 418 Internet Address Resolution SPI \(https://openjdk.java.net/jeps/418\)](https://openjdk.java.net/jeps/418)
- [JEP 419 Foreign Function & Memory API \(Second Incubator\) \(https://openjdk.java.net/jeps/419\)](https://openjdk.java.net/jeps/419)
- [JEP 420 Pattern Matching for switch \(Second Preview\) \(https://openjdk.java.net/jeps/420\)](https://openjdk.java.net/jeps/420)

Released	March 22, 2022
# of JEPs	9
Addition(s)	
Notable	UTF by default Javadoc code snippets
Preview(s)	Switch pattern matching
Incubating	Vector API Foreign function & memory API
Removal(s)	
Notable	Deprecated finalization for removal
Support ended	
Public	September 2022

- [JEP 421: Deprecate Finalization for Removal \(https://openjdk.java.net/jeps/421\)](https://openjdk.java.net/jeps/421)

Java 18 updates

Table of Java 18 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 18 ^[359]	2022-03-22	Initial release
Java SE 18.0.1 ^[360]	2022-04-19	New features ▪ New ML Processing Limit (xml/jaxp) Other notes ▪ Only Expose Certificates With Proper Trust Settings as Trusted Certificate Entries in macOS KeychainStore (security-libs/java.security) ▪ Parsing of URL String in Built in JNDI Provider More Strict (core-libs/javax.naming) Bug fixes ▪ 18 bug fixes^[361]
Java SE 18.0.1.1 ^[362]	2022-05-02	core-libs/java.io ▪ New System Property to Disable Window Alternate Data Stream Support in java.io.File (core-libs/java.io) Bug fixes ▪ 2 bug fixes^[363]
Java SE 18.0.2 ^[364]	2022-07-19	Removed features and options ▪ Remove the Alternate ThreadLocal Implementation of the Subject::current and Subject::callAs APIs (security-libs/javax.security) Other notes ▪ java.net.InetAddress Updated to Reject Ambiguous IPv4 Address Literals (core-libs/java.net) ▪ CPU Shares Ignored When Computing Active Processor Count (hotspot/runtime) ▪ Lambda Deserialization Fail for Object Method Reference on Interfaces (tools/javac) Bug fixes ▪ 49 bug fixes^[365]
Java SE 18.0.2.1 ^[366]	2022-08-18	Changes ▪ C2 Compilation Errors Unpredictably Crashes JVM (hotspot/compiler)

Java SE 19

JDK 19 was released on 20 September 2022.^[367]

- JEP 405 Record Patterns (Preview) (<https://openjdk.java.net/jeps/405>)
- JEP 422 Linux/RISC V Port (<https://openjdk.java.net/jeps/422>)
- JEP 424 Foreign Function & Memory API (Preview) (<https://openjdk.java.net/jeps/424>)
- JEP 425 Virtual Threads (Preview) (<https://openjdk.java.net/jeps/425>)
- JEP 426 Vector API (Fourth Incubator) (<https://openjdk.java.net/jeps/426>)
- JEP 427 Pattern Matching for switch (Third Preview) (<https://openjdk.java.net/jeps/427>)
- JEP 428 Structured Concurrency (Incubator) (<https://openjdk.java.net/jeps/428>)

Java SE 19

Released	September 20, 2022
# of JEPs	7
Addition(s)	
Preview(s)	Foreign function & memory API Switch pattern matching
Incubating	Vector API Structured concurrency
Support ended	
Public	March 2023

JEP 405 allows record patterns, extending the pattern matching capabilities of instanceof operators, and switch expressions, to include record patterns that explicitly refer to the components of the record.

```
record Rectangle(int x, int y, int w, int h) {}

int area(Object o) {
    if (o instanceof Rectangle(int x, int y, int w, int h)) {
        return w * h;
    }
    return 0;
}
```

Such patterns can include nested patterns, where the components of records are themselves records, allowing patterns to match more object graphs.

Java 19 updates

Table of Java 19 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 19 ^[368]	2022-09-20	Initial release
Java SE 19.0.1 ^[369]	2022-10-18	Other notes - Update Timezone Data to 2022c (core libs/java time) - New System Property to Limit the Number of Open Connections to com.sun.net.httpserver.HttpServer (core-libs/java.net) Bug fixes 6 bug fixes^[370]
Java SE 19.0.2 ^[371]	2023 01 17	New features - DTLS Resumption Uses HelloVerifyRequest Messages (security-libs/javax.net.ssl) Other notes - FXML JavaScript Engine Disabled by Default (javafx/fxml) Bug fixes 28 bug fixes^[372]

Java SE 20

Java 20 was released on 21 March 2023.^[373] All JEPs were either incubators or previews.

- JEP 429 Scoped Values (Incubator) (<https://openjdk.java.net/jeps/429>)
- JEP 432 Record Patterns (Second Preview) (<https://openjdk.java.net/jeps/432>)
- JEP 433 Pattern Matching for switch (Fourth Preview) (<https://openjdk.java.net/jeps/433>)
- JEP 434 Foreign Function & Memory API (Second Preview) (<https://openjdk.java.net/jeps/434>)
- JEP 436 Virtual Threads (Second Preview) (<https://openjdk.java.net/jeps/436>)
- JEP 437: Structured Concurrency (Second Incubator) (<https://openjdk.java.net/jeps/437>)

Java SE 20

Released	March 21, 2023
# of JEPs	7
Addition(s)	
Incubating	Scoped values
Support ends	
Public	September 2023

- JEP 438: Vector API (Fifth Incubator) (<https://openjdk.java.net/jeps/438>)

Java 20 updates

Table of Java 20 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 20 ^[374]	2023-03-21	Initial release
Java SE 20.0.1 ^[375]	2023-04-18	Other notes ■ System Property to Handle HTML ObjectView Creation (client libs/javafx.swing) ■ Added Certigna(Dhimyotis) CA Certificate (security-libs/java.security) ■ File::listRoots Changed to Return All Available Drives on Window (core libs/java.io) Bug fixes ■ 5 bug fixes^[376]
Java SE 20.0.2 ^[377]	2023-07-18	New features ■ Support for GB18030 2022 (core libs/java.nio.charsets) Known issues ■ Problem Upgrading JDK on Windows if System User Is Using Shared Files (install) Other notes ■ Missing /usr/java/default Symlink on Linux Restored (install/install) ■ Installation of JDK RPM Corrupts Alternatives (install/install) ■ Added TWCA Root CA Certificate (security-libs/java.security) ■ Added 4 GTS Root CA Certificates (security-libs/java.security) ■ Added Microsoft Corporation' 2 TLS Root CA Certificate (security-libs/java.security) ■ ASLR Support for CDS Archive (hotspot/runtime) ■ New System Property to Control the Maximum Size of Signature File (security-libs/java.security) ■ Improved ZIP64 Extra Field Validation (core-libs/java.util.jar) Bug fixes ■ 33 bug fixes^[378]

Java SE 21

Java 21 was released on 19 September 2023.^[379] There are eight JEPs that aren't in preview or incubating, compared to Java 20 which only had previewing and incubating JEPs. Java 21

Java SE 21

LTS version

Releasing September 19, 2023

introduces features first previewed in Java 17 (pattern matching for switch statements) and Java 19 (record patterns). The 32bit version of Windows on x86 has been deprecated for removal.

- JEP 430 String Templates (Preview) (<https://openjdk.java.net/jeps/430>)
- JEP 431 Sequenced Collections (<https://openjdk.java.net/jeps/431>)
- JEP 439 Generational ZGC (<https://openjdk.java.net/jeps/439>)
- JEP 440 Record Patterns (<https://openjdk.java.net/jeps/440>)
- JEP 441: Pattern Matching for switch (<https://openjdk.java.net/jeps/441>)
- JEP 442: Foreign Function & Memory API (Third Preview) (<https://openjdk.java.net/jeps/442>)
- JEP 443 Unnamed Patterns and Variables (Preview) (<https://openjdk.java.net/jeps/443>)
- JEP 444: Virtual Threads (<https://openjdk.java.net/jeps/444>)
- JEP 445 Unnamed Classes and Instance Main Methods (Preview) (<https://openjdk.java.net/jeps/445>)
- JEP 446 Scoped Values (Preview) (<https://openjdk.java.net/jeps/446>)
- JEP 448: Vector API (Sixth Incubator) (<https://openjdk.java.net/jeps/448>)
- JEP 449 Deprecate the Windows 32 bit x86 Port for Removal (<https://openjdk.java.net/jeps/449>)
- JEP 451: Prepare to Disallow the Dynamic Loading of Agents (<https://openjdk.java.net/jeps/451>)
- JEP 452 Key Encapsulation Mechanism API (<https://openjdk.java.net/jeps/452>)
- JEP 453: Structured Concurrency (Preview) (<https://openjdk.java.net/jeps/453>)

# of JEPs	15
Addition(s)	
Notable	Record pattern , pattern matching for switch, virtual threads
Preview(s)	String template , unnamed classes and main methods
Incubating	Vector API

JEP 445, previewing unnamed classes, allows for a barebones Main class without boilerplate code:

```
1 void main() {
2     System.out.println("Hello, World!");
3 }
```

instead of :

```
1 public class HelloWorld {
2     public static void main(String[] args) {
3         System.out.println("Hello, World!");
4     }
5 }
```

Java 21 updates

Table of Java 21 updates [\[show\]](#)

Release	Release date	Highlights
Java SE 21 ^[380]	2023-03-19	Initial release
Java SE 20.0.1 ^[381]	2023-10-17	Other notes - Added Certigna Root CA Certificate (security libs/java security) - Increase Default Value of the System Property jdk.jar.maxSignatureFileSize (security-libs/java.security) Bug fixes 40 bug fixes^[382]

Java SE 22

As of June 2023, the specification for Java 22 has not yet been finalized. Java 22 is scheduled for release in March 2024.^[383]

Java SE 22

Releasing

March 2024

Future features

- Project Valhalla (<https://openjdk.java.net/projects/valhalla/>): *Value classes*, whose objects lack identity, but can in certain cases get an improved memory layout (with less indirection), or have their allocation optimized away entirely.
- Project Panama (<https://openjdk.java.net/projects/panama/>): *Improved interoperability with native code*, to enable Java source code to call functions and use data types from other languages, in a way that is easier and has better performance than today. Vector API (a portable and relatively low-level abstraction layer for SIMD programming) is also developed under Project Panama umbrella.
- Project Lilliput (<https://wiki.openjdk.org/display/lilliput>): *Reduce the size of Java object headers*. First down to 64 bits, and then down to 32 bits.

Implementations

The officially supported Java platform, first developed at Sun and now stewarded by Oracle, is Java SE. Releases are based on the OpenJDK project, a free and open source project with an open development model. Other Java implementations exist, however—in part due to Java's early history as proprietary software. In contrast, some implementations were created to offer some benefits over the standard implementation, often the result of some area of academic or corporate-sponsored research. Many Linux distributions include builds of OpenJDK through the IcedTea project started by Red Hat, which provides a more straightforward build and integration environment.

Visual J++ and the Microsoft Java Virtual Machine were created as incompatible implementations. After the *Sun v. Microsoft* lawsuit, Microsoft abandoned it and began work on the .NET platform. In 2021, Microsoft started distributing compatible "Microsoft Build of OpenJDK" for Java 11 first then also for Java 17. Their builds support not only Windows, but also Linux and macOS.

Other proprietary Java implementations are available, such as Azul's Zing. Azul offers certified open source OpenJDK builds under the Zulu moniker.

Prior to the release of OpenJDK, while Sun's implementation was still proprietary, the GNU Classpath project was created to provide a free and open-source implementation of the Java platform. Since the release of JDK 7, when OpenJDK became the official reference implementation, the original motivation for the GNU Classpath project almost completely disappeared, and its last release was in 2012.

The Apache Harmony project was started shortly before the release of OpenJDK. After Sun's initial source code release, the Harmony project continued, working to provide an implementation under a lax license, in contrast to the protective license chosen for OpenJDK. Google later developed Android and released it under a lax license. Android incorporated parts of the Harmony project, supplemented with Google's own Dalvik virtual machine and ART. Apache Harmony has since been retired, and Google has switched its Harmony components with equivalent ones from OpenJDK.

Both Jikes and Jikes RVM are open-source research projects that IBM developed.

Several other implementations exist that started as proprietary software but are now open source. IBM initially developed OpenJ9 as the proprietary J9^[384] but has since relicensed the project and donated it to the Eclipse Foundation. JRockit is a proprietary implementation that was acquired by Oracle and incorporated into subsequent OpenJDK versions.

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