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## by inline-source v2014-01-03.01
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# libtool (GNU libtool) 2.4.6
```

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# Provide generalized library-building support services.
```

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# Written by Gordon Matzigkeit <gord@gnu.ai.mit.edu>, 1996
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/\* From openssh 4.3p2 filename openbsd-compat/fake-rfc2553.h \*/

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/\*

\* FILE: sha2.c

\* AUTHOR: Aaron D. Gifford - <http://www.aarongifford.com/>

\*

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\*

\* Modified by Jelte Jansen to fit in ldns, and not clash with any

\* system-defined SHA code.

\* Changes:

\* - Renamed (external) functions and constants to fit ldns style

\* - Removed \_End and \_Data functions

\* - Added ldns\_shaX(data, len, digest) convenience functions

\* - Removed prototypes of \_Transform functions and made those static

\*

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\* \$Id:

sha2.c,v 1.1 2001/11/08 00:01:51 adg Exp adg \$

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base64.cpp and base64.h

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Ren Nyffenegger rene.nyffenegger@adp-gmbh.ch

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\*\*\*\*\* UTF8 Validation logic (utf8\_validation.hpp) \*\*\*\*\*

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## 1.5 minizip 1.01

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## HTML parser and pretty printer

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## 1.12 json-c 0.14

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## 1.13 util-linux 2.31.1

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```
* /guava-30-1-1-android-sources-jar/com/google/common/collect/EnumBiMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingSortedSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableList.java
*
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingCollection.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractSetMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Multisets.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Ordering.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/NullsLastOrdering.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingMapEntry.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ClassToInstanceMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractMapEntry.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/SingletonImmutableSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ListMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedSetMultimap.java
*
* /guava-30-1-1-android-sources-jar/com/google/common/collect/TreeMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/LinkedListMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Interners.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/UsingToStringOrdering.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Maps.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ComparatorOrdering.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingSortedMap.java
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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/SetMultimap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Lists.java
- \*
- /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingMultiset.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingMultimap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Multiset.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/MutableClassToInstanceMap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableSet.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/package-info.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingQueue.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractBiMap.java
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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/LinkedHashMultimap.java
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- /guava-30-1-1-android-sources-jar/com/google/common/collect/ConcurrentHashMultiset.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Multimap.java
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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingConcurrentMap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingObject.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/BiMap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Iterables.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractSortedSetMultimap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/MapDifference.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractListMultimap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/HashMultimap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Multimaps.java
- \*
- /guava-30-1-1-android-sources-jar/com/google/common/collect/ReverseNaturalOrdering.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractMultiset.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Sets.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingListIterator.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Synchronized.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/CompoundOrdering.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/NaturalOrdering.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ReverseOrdering.java
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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/NullsFirstOrdering.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingList.java
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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/HashMultiset.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractMapBasedMultimap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/EnumHashBiMap.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/LinkedHashMultiset.java



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* /guava-30-1-1-android-sources-jar/com/google/common/primitives/ImmutableDoubleArray.java
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/**
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*
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wouldn't recognize
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\* /guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractBaseGraph.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/graph/BaseGraph.java  
\*

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\* /guava-30-1-1-android-sources-jar/com/google/common/base/CommonPattern.java  
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\* /guava-30-1-1-android-sources-jar/com/google/common/math/BigDecimalMath.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/io/Java8Compatibility.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/OverflowAvoidingLockSupport.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/hash/Java8Compatibility.java  
\*

/guava-30-1-1-android-sources-jar/com/google/common/math/ToDoubleRounder.java

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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/GwtTransient.java

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- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractNetwork.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/UndirectedMultiNetworkConnections.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/LinkedHashMultimapGwtSerializationDependencies.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/UndirectedNetworkConnections.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/DirectedMultiNetworkConnections.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/MapIteratorCache.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/ForwardingNetwork.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/DirectedGraphConnections.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/StandardValueGraph.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/HashMultimapGwtSerializationDependencies.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/NetworkBuilder.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/EdgesConnecting.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMultisetGwtSerializationDependencies.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/ElementOrder.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/StandardMutableGraph.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/GraphConstants.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/ImmutableValueGraph.java

```

* /guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractGraphBuilder.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/NetworkConnections.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/MutableValueGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/StandardMutableValueGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/StandardNetwork.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/MapRetrievalCache.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractDirectedNetworkConnections.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/UndirectedGraphConnections.java
*
/guava-30-1-1-android-sources-jar/com/google/common/graph/ValueGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/GraphBuilder.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/EndpointPairIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Comparators.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/DirectedNetworkConnections.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/ForwardingGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/StandardMutableNetwork.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/GraphConnections.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/EndpointPair.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RangeGwtSerializationDependencies.java
* /guava-30-1-1-android-sources-
jar/com/google/common/collect/ArrayListMultimapGwtSerializationDependencies.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/MultiEdgesConnecting.java
*
/guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractUndirectedNetworkConnections.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/ForwardingValueGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/AbstractValueGraph.java
* /guava-30-1-1-android-sources-jar/com/google/common/graph/ValueGraphBuilder.java
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```

* /guava-30-1-1-android-sources-jar/com/google/common/hash/LittleEndianByteArray.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/InterruptibleTask.java

```

```

* /guava-30-1-1-android-sources-jar/com/google/common/hash/MacHashFunction.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/ReaderInputStream.java
*
/guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AggregateFutureState.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Platform.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ConsumingQueueIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AsyncCallable.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/FarmHashFingerprint64.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/CombinedFuture.java
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* /guava-30-1-1-android-sources-jar/com/google/common/graph/IncidentEdgeSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/CompactHashing.java
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- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/TopKSelector.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/SuccessorsFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/Graph.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/PredecessorsFunction.java
- \*
- /guava-30-1-1-android-sources-jar/com/google/common/graph/ImmutableGraph.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/Graphs.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/MutableGraph.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/Network.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/MutableNetwork.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/graph/ImmutableNetwork.java

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/\*\*

\* Not supported. <b>You are attempting to create a map that may contain a non-{@code Comparable}  
\* key.</b> Proper calls will resolve to the version in {@code ImmutableSortedMap}, not this dummy  
\* version.

\*

\* @throws UnsupportedOperationException always

\* @deprecated <b>Pass a key of type {@code Comparable}

to use {@link

\* `ImmutableSortedMap#of(Comparable, Object)}`.</b>

\*/

Found in path(s):

- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSortedMapFauxverideShim.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/hash/ImmutableSupplier.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ExecutionSequencer.java  
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\* /guava-30-1-1-android-sources-jar/com/google/common/net/package-info.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Atomics.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/base/Strings.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ThreadFactoryBuilder.java  
 \*  
 /guava-30-1-1-android-sources-jar/com/google/common/base/Ascii.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/collect/ContiguousSet.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Monitor.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingBlockingQueue.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/base/Equivalence.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedLists.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/UncaughtExceptionHandler.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/primitives/package-info.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/annotations/Beta.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ListeningExecutorService.java  
 \* /guava-30-1-1-android-sources-jar/com/google/common/annotations/package-info.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/TimeoutFuture.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/GwtFuturesCatchingSpecialization.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/annotations/VisibleForTesting.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/GwtFluentFutureCatchingSpecialization.java  
\*  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/FuturesGetChecked.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/SimpleTimeLimiter.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/FakeTimeLimiter.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/io/AppendableWriter.java

```

* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Futures.java
* /guava-30-1-1-android-sources-jar/com/google/common/reflect/TypeToken.java
* /guava-30-1-1-android-sources-jar/com/google/common/escape/CharEscaperBuilder.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/FluentFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractTransformFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractCatchingFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AggregateFuture.java
*
* /guava-30-1-1-android-sources-jar/com/google/common/escape/CharEscaper.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/CollectionFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ImmediateFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/PatternFilenameFilter.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/TimeLimiter.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/UncheckedTimeoutException.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/CaseFormat.java

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/*
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*/

```

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```

* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/MoreExecutors.java

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/\*\*

\* Holder for web specializations of methods of { @code Doubles}. Intended to be empty for regular  
\* version.

\*/

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\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/DoublesMethodsForWeb.java

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/*
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*
* As of 2010/06/11, this method is identical to the (package private) hash method in OpenJDK 7's
* java.util.HashMap
class.
*/

```

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`/guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Striped.java`

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`/guava-30-1-1-android-sources-jar/com/google/common/collect/IndexedImmutableSet.java`

`/guava-30-1-1-android-sources-jar/com/google/common/collect/BaseImmutableMultimap.java`

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*/
/**
 * Returns an array containing all of the elements in the specified collection. This method
 * returns the elements in the order they are returned by the collection's iterator. The returned
 * array is "safe" in that no references to it are maintained by the collection. The caller is
 * thus free to modify the returned
array.
*
* <p>This method assumes that the collection size doesn't change while the method is running.
*
* <p>TODO(kevinb): support concurrently modified collections?
*
* @param c the collection for which to return an array of elements
*/

```

Found in path(s):

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ObjectArrays.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/collect/MultimapBuilder.java

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Found in path(s):

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/ImmutableTypeToInstanceMap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/MutableTypeToInstanceMap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/CharSource.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/CartesianList.java

\*

\*/guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableRangeMap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/escape/package-info.java

\* /guava-30-1-1-android-sources-jar/com/google/common/hash/LongAddable.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/BaseEncoding.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/ByteSource.java

\* /guava-30-1-1-android-sources-jar/com/google/common/math/PairedStatsAccumulator.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/AbstractInvocationHandler.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/ClassPath.java

\* /guava-30-1-1-android-sources-jar/com/google/common/math/StatsAccumulator.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/Closer.java

\* /guava-30-1-1-android-sources-jar/com/google/common/xml/package-info.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/SmoothRateLimiter.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ListenableScheduledFuture.java

\*

\*/guava-30-1-1-android-sources-jar/com/google/common/math/PairedStats.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/Invokable.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/TypeCapture.java

\* /guava-30-1-1-android-sources-jar/com/google/common/math/Stats.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/RateLimiter.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/Parameter.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/TypeToInstanceMap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/reflect/Element.java

\* /guava-30-1-1-android-sources-jar/com/google/common/cache/LongAddables.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/FileWriteMode.java

\* /guava-30-1-1-android-sources-jar/com/google/common/hash/LongAddables.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/ByteSink.java

\*

```

/guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ServiceManager.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/StandardSystemProperty.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/CharSink.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/AbstractByteHasher.java
* /guava-30-1-1-android-sources-jar/com/google/common/math/LinearTransformation.java
* /guava-30-1-1-android-sources-jar/com/google/common/html/package-info.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/SipHashFunction.java
* /guava-30-1-1-android-sources-jar/com/google/common/reflect/package-info.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/ChecksumHashFunction.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableRangeSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredKeyMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/LongAddable.java
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```

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```

* /guava-30-1-1-android-sources-jar/com/google/common/hash/LongAdder.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/Striped64.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/LongAdder.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/Striped64.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AtomicDoubleArray.java
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```

Found in path(s):

```

* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableEntry.java
* /guava-30-1-1-android-sources-jar/com/google/thirdparty/publicsuffix/PublicSuffixPatterns.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/CollectPreconditions.java

```



```

* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMapEntrySet.java
*
/guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMapKeySet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableCollection.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Table.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSortedSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/UnmodifiableIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableBiMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/TreeBasedTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableBiMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Platform.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableListMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Tables.java
*
/guava-30-1-1-android-sources-jar/com/google/common/collect/Range.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/HashBasedTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Collections2.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/StandardTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Serialization.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/StandardRowSortedTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/PeekingIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/EmptyImmutableListMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableMapValues.java
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```

* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/SubscriberRegistry.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/MoreObjects.java
* /guava-30-1-1-android-sources-jar/com/google/common/math/Quantiles.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/Subscriber.java
*
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/Dispatcher.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/TrustedListenableFutureTask.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ListenerCallQueue.java
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```

* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/reflect/TypeVisitor.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/VerifyException.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Runnables.java
*

```

```

/guava-30-1-1-android-sources-jar/com/google/common/base/Verify.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/HashingInputStream.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/WrappingScheduledExecutorService.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/SubscriberExceptionContext.java
* /guava-30-1-1-android-sources-jar/com/google/thirdparty/publicsuffix/PublicSuffixType.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Utf8.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredMultimapValues.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/CharSequenceReader.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/SubscriberExceptionHandler.java
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*/
/**
* Holder for web specializations of methods of { @code Shorts}. Intended to be empty for regular
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*/

```

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Found in path(s):
* /guava-30-1-1-android-sources-jar/com/google/common/primitives/ShortsMethodsForWeb.java
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/\*\*

\* Holder for web specializations of methods of { @code Ints }. Intended to be empty for regular  
\* version.  
\*/

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\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/IntsMethodsForWeb.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingSetMultimap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingSortedSetMultimap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/RowSortedTable.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingImmutableCollection.java

\*

/\*guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractSequentialIterator.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/UnmodifiableListIterator.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingListMultimap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/MinMaxPriorityQueue.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedMapDifference.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/base/Converter.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/net/PercentEscaper.java  
\* /guava-30-1-1-android-sources-jar/com/google/thirdparty/publicsuffix/TrieParser.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Booleans.java  
\*  
/guava-30-1-1-android-sources-jar/com/google/common/base/internal/Finalizer.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Doubles.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/base/CharMatcher.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Floats.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/SequentialExecutor.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Bytes.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ListenableFutureTask.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/collect/FluentIterable.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/base/Stopwatch.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/io/FileBackedOutputStream.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Shorts.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Ints.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Chars.java  
\*  
/guava-30-1-1-android-sources-jar/com/google/common/io/MultiReader.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/base/Joiner.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/escape/UnicodeEscaper.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Longs.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/net/InetAddresses.java  
\* /guava-30-1-1-android-sources-jar/com/google/common/escape/Escaper.java  
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* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSortedMultisetFauxverideShim.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RangeSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedIterable.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedIterables.java
*
/guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractRangeSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSortedMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/GeneralRange.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableSortedMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingSortedMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Count.java
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* /guava-30-1-1-android-sources-jar/com/google/common/io/Resources.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/package-info.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/FinalizablePhantomReference.java
*
/guava-30-1-1-android-sources-jar/com/google/common/base/Suppliers.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Charsets.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/LineReader.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/FinalizableSoftReference.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/CharStreams.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Predicate.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/ByteStreams.java
* /guava-30-1-1-android-sources-jar/com/google/common/primitives/Primitives.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/LineBuffer.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/FinalizableWeakReference.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Predicates.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Functions.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/AbstractIterator.java
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*
/guava-30-1-1-android-sources-jar/com/google/common/base/package-info.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/HashBiMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/DeadEvent.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/FinalizableReference.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/Subscribe.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Objects.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Supplier.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/MultiInputStream.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/Interners.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/EnumMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ExecutionList.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/package-info.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Defaults.java
*
/guava-30-1-1-android-sources-jar/com/google/common/base/Function.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/FinalizableReferenceQueue.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/Closeables.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/AllowConcurrentEvents.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/Files.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/AsyncEventBus.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/LittleEndianDataOutputStream.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/EventBus.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/CountingOutputStream.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Throwables.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ListenableFuture.java
*
/guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/DirectExecutor.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/CountingInputStream.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/LittleEndianDataInputStream.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/Flushables.java
* /guava-30-1-1-android-sources-jar/com/google/common/eventbus/package-info.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableClassToInstanceMap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableSortedSet.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ArrayTable.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSortedMap.java

\*

/guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingTable.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/DiscreteDomain.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableList.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSetMultimap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableAsList.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/SingletonImmutableTable.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/EmptyImmutableSetMultimap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableSortedSetFauxverideShim.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ComputationException.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ComparisonChain.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractIndexedListAdapter.java

\*

/guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableEnumSet.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableTable.java

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\* /guava-30-1-1-android-sources-jar/com/google/common/cache/package-info.java

\* /guava-30-1-1-android-sources-jar/com/google/common/hash/AbstractHasher.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractListeningExecutorService.java

\* /guava-30-1-1-android-sources-jar/com/google/common/primitives/UnsignedInts.java

\*

/guava-30-1-1-android-sources-jar/com/google/common/primitives/UnsignedLongs.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ListeningScheduledExecutorService.java



- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/Crc32cHashFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/CacheLoader.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/AbstractCache.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/math/package-info.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AsyncFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/AbstractNonStreamingHashFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/primitives/ParseRequest.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/Funnel.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/RemovalNotification.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/TreeRangeSet.java
- \*
- /guava-30-1-1-android-sources-jar/com/google/common/cache/Weigher.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Uninterruptibles.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/net/HostAndPort.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/AbstractCompositeHashFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/BloomFilterStrategies.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/HashCode.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ExecutionError.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/MessageDigestHashFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/Murmur3\_128HashFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/math/IntMath.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/Hashing.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/base/Optional.java
- \*
- /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/UncheckedExecutionException.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/math/LongMath.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/BoundType.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/primitives/UnsignedLong.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/BloomFilter.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/CycleDetectingLockFactory.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/RemovalListeners.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/collect/Queues.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/math/BigIntegerMath.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/CacheBuilderSpec.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/net/HttpHeaders.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingExecutorService.java
- \*
- /guava-30-1-1-android-sources-jar/com/google/common/collect/DescendingImmutableSortedMultiset.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/base/Ticker.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/HashingOutputStream.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/reflect/Types.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/Funnels.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/FutureCallback.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/ForwardingLoadingCache.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/PrimitiveSink.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/hash/HashFunction.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/math/DoubleMath.java
- \* /guava-30-1-1-android-sources-jar/com/google/common/cache/RemovalListener.java

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* /guava-30-1-1-android-sources-jar/com/google/common/hash/Hasher.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Enums.java
*
/guava-30-1-1-android-sources-jar/com/google/common/cache/LoadingCache.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Present.java
* /guava-30-1-1-android-sources-jar/com/google/common/math/MathPreconditions.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractSortedMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractScheduledService.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularContiguousSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/CacheStats.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/AbstractStreamingHasher.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/Cache.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AtomicLongMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/RemovalCause.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/WrappingExecutorService.java
*
/guava-30-1-1-android-sources-jar/com/google/common/base/PairwiseEquivalence.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingListeningExecutorService.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/AbstractLoadingCache.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Absent.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/ForwardingCache.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/FunctionalEquivalence.java
* /guava-30-1-1-android-sources-jar/com/google/common/hash/Murmur3_32HashFunction.java
* /guava-30-1-1-android-sources-jar/com/google/common/math/DoubleUtils.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/EmptyContiguousSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/reflect/TypeParameter.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableMultiset.java
*
/guava-30-1-1-android-sources-jar/com/google/common/primitives/UnsignedInteger.java
* /guava-30-1-1-android-sources-jar/com/google/common/net/MediaType.java
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```
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredEntrySetMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingImmutableSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedMultisetBridge.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/DescendingImmutableSortedSet.java
*
/guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredKeySetMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ImmutableEnumMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredEntryMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/DescendingMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/TreeRangeMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingNavigableSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AllEqualOrdering.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/TreeTraverser.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableAsList.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/CompactHashMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/TransformedIterator.java
*
/guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingBlockingDeque.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingDeque.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractSortedKeySortedSetMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingNavigableMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/TransformedListIterator.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingBlockingDeque.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingImmutableList.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/CompactHashSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/EvictingQueue.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredSetMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/CompactLinkedHashMap.java
*
/guava-30-1-1-android-sources-jar/com/google/common/collect/CompactLinkedHashSet.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/AbstractNavigableMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/ForwardingImmutableMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredKeyListMultimap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/UnmodifiableSortedMultiset.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RangeMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/FilteredMultimap.java
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\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingFuture.java

\* /guava-30-1-1-android-sources-jar/com/google/common/base/Splitter.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/ByteArrayDataInput.java

\*

/guava-30-1-1-android-sources-jar/com/google/common/annotations/GwtIncompatible.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingListenableFuture.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/MapMakerInternalMap.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Service.java

\* /guava-30-1-1-android-sources-jar/com/google/common/annotations/GwtCompatible.java

\* /guava-30-1-1-android-sources-jar/com/google/common/escape/ArrayBasedUnicodeEscaper.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/Cut.java

\* /guava-30-1-1-android-sources-jar/com/google/common/escape/Escapers.java

\* /guava-30-1-1-android-sources-jar/com/google/common/net/HostSpecifier.java

\* /guava-30-1-1-android-sources-jar/com/google/common/cache/LocalCache.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/LineProcessor.java

\* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/JdkFutureAdapters.java

\*

/guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractIdleService.java

\* /guava-30-1-1-android-sources-jar/com/google/common/io/ByteArrayDataOutput.java

\* /guava-30-1-1-android-sources-jar/com/google/common/cache/CacheBuilder.java

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* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/AbstractService.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/SparseImmutableTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/RegularImmutableTable.java
* /guava-30-1-1-android-sources-jar/com/google/common/reflect/TypeResolver.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/MapMaker.java
* /guava-30-1-1-android-sources-jar/com/google/common/cache/ReferenceEntry.java
* /guava-30-1-1-android-sources-jar/com/google/common/net/InternetDomainName.java
* /guava-30-1-1-android-sources-jar/com/google/common/html/HtmlEscapers.java
* /guava-30-1-1-android-sources-jar/com/google/common/collect/DenseImmutableTable.java
*
/guava-30-1-1-android-sources-jar/com/google/common/net/UrlEscapers.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/Callables.java
* /guava-30-1-1-android-sources-jar/com/google/common/escape/ArrayBasedEscaperMap.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/SettableFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/primitives/SignedBytes.java
* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ForwardingFluentFuture.java
* /guava-30-1-1-android-sources-jar/com/google/common/escape/ArrayBasedCharEscaper.java
* /guava-30-1-1-android-sources-jar/com/google/common/io/ByteProcessor.java
* /guava-30-1-1-android-sources-jar/com/google/common/xml/XmlEscapers.java
* /guava-30-1-1-android-sources-jar/com/google/common/primitives/UnsignedBytes.java
* /guava-30-1-1-android-sources-jar/com/google/common/escape/Platform.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Platform.java
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/*
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\* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedMultiset.java

\* /guava-30-1-1-android-sources-jar/com/google/common/collect/SortedMultisets.java

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express
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* the License.
*/
/**
* Holder for web specializations of methods of { @code Floats }. Intended to be empty for regular
* version.
*/

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Found in path(s):

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* /guava-30-1-1-android-sources-jar/com/google/common/util/concurrent/ServiceManagerBridge.java
* /guava-30-1-1-android-sources-jar/com/google/common/base/Java8Usage.java

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## 1.19 google-play-services 18.0.1

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## 1.20 kotlin 1.6.10

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* /okio-3-0-0-sources-jar/nonJvmTest/okio/utilNonJvm.kt
* /okio-3-0-0-sources-jar/mingwX64Main/okio/WindowsFileHandle.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/FixedLengthSourceTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/TimeoutTest.kt
* /okio-3-0-0-sources-jar/jvmMain/okio/internal/FixedLengthSource.kt
*
* /okio-3-0-0-sources-jar/jvmTest/okio/ZipFileSystemTest.kt
* /okio-3-0-0-sources-jar/unixMain/okio/UnixFileHandle.kt
* /okio-3-0-0-sources-jar/nativeMain/okio/FileSystem.kt
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\* /okio-3-0-0-sources-jar/jvmTest/okio/FileHandleTestingFileSystem.kt  
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\* /okio-3-0-0-sources-jar/commonTest/okio/HashingSourceTest.kt

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* /okio-3-0-0-sources-jar/jvmTest/okio/LargeStreamsTest.java
* /okio-3-0-0-sources-jar/jvmMain/okio/Pipe.kt
* /okio-3-0-0-sources-jar/jvmMain/okio/HashingSource.kt
*
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/okio-3-0-0-sources-jar/nonJvmMain/okio/ByteString.kt
* /okio-3-0-0-sources-jar/commonMain/okio/ByteString.kt
* /okio-3-0-0-sources-jar/commonMain/okio/-Util.kt
* /okio-3-0-0-sources-jar/nonJvmMain/okio/-NonJvmPlatform.kt
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Found in path(s):

\* /okio-3-0-0-sources-jar/jvmMain/okio/ByteString.kt  
\* /okio-3-0-0-sources-jar/jvmTest/okio/ByteStringJavaTest.java  
\* /okio-3-0-0-sources-jar/commonTest/okio/HashingTest.kt

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Found in path(s):

\* /okio-3-0-0-sources-jar/jvmMain/okio/internal/zip.kt

\* /okio-3-0-0-sources-jar/jvmMain/okio/internal/ZipEntry.kt

\*

/okio-3-0-0-sources-jar/jvmMain/okio/ZipFileSystem.kt

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\* /okio-3-0-0-sources-jar/nonJvmMain/okio/internal/Sha512.kt

\* /okio-3-0-0-sources-jar/jvmTest/okio/internal/Md5.kt

\* /okio-3-0-0-sources-jar/jvmTest/okio/MessageDigestConsistencyTest.kt

\* /okio-3-0-0-sources-jar/nonJvmMain/okio/internal/Sha256.kt

\* /okio-3-0-0-sources-jar/nonJvmMain/okio/internal/Md5.kt

\* /okio-3-0-0-sources-jar/nonJvmMain/okio/internal/Sha1.kt

\*

/okio-3-0-0-sources-jar/jvmTest/okio/internal/Sha512.kt

\* /okio-3-0-0-sources-jar/jvmTest/okio/internal/Sha256.kt

\* /okio-3-0-0-sources-jar/jvmTest/okio/internal/Sha1.kt

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\* /okio-3-0-0-sources-jar/jvmMain/okio/ForwardingTimeout.kt  
\* /okio-3-0-0-sources-jar/jvmMain/okio/SegmentedByteString.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/SegmentedByteString.kt  
\* /okio-3-0-0-sources-jar/jvmTest/okio/SegmentSharingTest.kt  
\* /okio-3-0-0-sources-jar/nonJvmMain/okio/SegmentedByteString.kt  
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\* /okio-3-0-0-sources-jar/jvmTest/okio/BufferFactory.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/Buffer.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/Okio.kt  
\* /okio-3-0-0-sources-jar/nonJvmMain/okio/Sink.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/Source.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/Sink.kt  
\*  
\* /okio-3-0-0-sources-jar/commonMain/okio/RealBufferedSink.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/RealBufferedSource.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/internal/-Buffer.kt  
\* /okio-3-0-0-sources-jar/commonTest/okio/CommonRealBufferedSinkTest.kt  
\* /okio-3-0-0-sources-jar/commonTest/okio/AbstractBufferedSourceTest.kt  
\* /okio-3-0-0-sources-jar/nonJvmMain/okio/BufferedSink.kt  
\* /okio-3-0-0-sources-jar/commonTest/okio/BufferCommonTest.kt  
\* /okio-3-0-0-sources-jar/nonJvmMain/okio/BufferedSource.kt  
\* /okio-3-0-0-sources-jar/commonMain/okio/BufferedSink.kt

```

* /okio-3-0-0-sources-jar/commonTest/okio/AbstractBufferedSinkTest.kt
* /okio-3-0-0-sources-jar/nonJvmMain/okio/RealBufferedSink.kt
* /okio-3-0-0-sources-jar/commonTest/okio/CommonRealBufferedSourceTest.kt
* /okio-3-0-0-sources-jar/commonTest/okio/CommonOkioKotlinTest.kt
* /okio-3-0-0-sources-jar/commonMain/okio/Timeout.kt
* /okio-3-0-0-sources-jar/commonTest/okio/BufferedSinkFactory.kt
* /okio-3-0-0-sources-jar/nonJvmMain/okio/Timeout.kt
*

```

```

/okio-3-0-0-sources-jar/commonTest/okio/util.kt
* /okio-3-0-0-sources-jar/commonMain/okio/BufferedSource.kt
* /okio-3-0-0-sources-jar/commonTest/okio/BufferedSourceFactory.kt
* /okio-3-0-0-sources-jar/nonJvmMain/okio/Buffer.kt

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```

* /okio-3-0-0-sources-jar/jvmTest/okio/ForwardingTimeoutKotlinTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/GzipKotlinTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/ByteStringKotlinTest.kt
* /okio-3-0-0-sources-jar/jvmMain/okio/-DeprecatedUtf8.kt
* /okio-3-0-0-sources-jar/jvmMain/okio/-DeprecatedUpgrade.kt
*
/okio-3-0-0-sources-jar/jvmTest/okio/BufferCursorTest.java
* /okio-3-0-0-sources-jar/jvmTest/okio/PipeKotlinTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/NioTest.java
* /okio-3-0-0-sources-jar/jvmTest/okio/BufferKotlinTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/ThrottlerTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/ThrottlerTakeTest.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/DeflateKotlinTest.kt
* /okio-3-0-0-sources-jar/jvmMain/okio/Throttler.kt
* /okio-3-0-0-sources-jar/jvmTest/okio/BufferCursorKotlinTest.kt
* /okio-3-0-0-sources-jar/commonMain/okio/PeekSource.kt
* /okio-3-0-0-sources-jar/commonTest/okio/CommonOptionsTest.kt

```

- \* /okio-3-0-0-sources-jar/jvmTest/okio/ForwardingTimeoutTest.java
- \* /okio-3-0-0-sources-jar/jvmTest/okio/OkioKotlinTest.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/-DeprecatedOkio.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/Stopwatch.kt
- \* /okio-3-0-0-sources-jar/commonTest/okio/Utf8KotlinTest.kt

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- \* /okio-3-0-0-sources-jar/nonJvmMain/okio/RealBufferedSource.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/GzipSink.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/RealBufferedSource.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/BufferedSinkTest.java
- \* /okio-3-0-0-sources-jar/jvmTest/okio/TestUtil.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/AsyncTimeout.kt
- \*
  - /okio-3-0-0-sources-jar/jvmMain/okio/BufferedSink.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/GzipSource.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/OkioTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/BufferedSource.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/Timeout.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/SocketTimeoutTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/Buffer.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/BufferedSinkJavaTest.java
- \* /okio-3-0-0-sources-jar/commonTest/okio/MockSink.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/GzipSinkTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/ForwardingSource.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/DeflaterSinkTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/DeflaterSink.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/AsyncTimeoutTest.java
- \* /okio-3-0-0-sources-jar/jvmTest/okio/ReadUtf8LineTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/ForwardingSink.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/SegmentPool.kt

- \* /okio-3-0-0-sources-jar/jvmTest/okio/GzipSourceTest.java
- \*
- /okio-3-0-0-sources-jar/jvmMain/okio/InflaterSource.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/JvmOkio.kt
- \* /okio-3-0-0-sources-jar/nonJvmMain/okio/SegmentPool.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/BufferedSourceTest.java
- \* /okio-3-0-0-sources-jar/commonTest/okio/CommonBufferTest.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/BufferedSourceJavaTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/Sink.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/SegmentPool.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/Utf8Test.java
- \* /okio-3-0-0-sources-jar/jvmTest/okio/InflaterSourceTest.java
- \* /okio-3-0-0-sources-jar/jvmTest/okio/BufferTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/RealBufferedSink.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/Segment.kt

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- \* /okio-3-0-0-sources-jar/nonJvmMain/okio/internal/HashFunction.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/internal/HashFunction.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/CipherSink.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/CipherAlgorithm.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/CipherSinkTest.kt
- \*
- /okio-3-0-0-sources-jar/jvmTest/okio/CipherSourceTest.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/CipherSource.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/CipherFactory.kt

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- \* /okio-3-0-0-sources-jar/commonMain/okio/internal/-RealBufferedSource.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/internal/-RealBufferedSink.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/internal/-SegmentedByteString.kt

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- \* /okio-3-0-0-sources-jar/commonTest/okio/FakeFileSystemTest.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/HashingSource.kt
- \* /okio-3-0-0-sources-jar/mingwX64Main/okio/-Windows.kt
- \* /okio-3-0-0-sources-jar/commonTest/okio/PathTest.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/HashingSink.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/FileMetadata.kt
- \*
- /okio-3-0-0-sources-jar/commonTest/okio/ForwardingFileSystemTest.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/Path.kt
- \* /okio-3-0-0-sources-jar/sizet64Main/okio/-Sizet64.kt
- \* /okio-3-0-0-sources-jar/jsMain/okio/-JsPlatform.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/ExperimentalFileSystem.kt

- \* /okio-3-0-0-sources-jar/sizet32Main/okio/-Sizet32.kt
- \* /okio-3-0-0-sources-jar/nativeMain/okio/-Cinterop.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/internal/-Path.kt
- \* /okio-3-0-0-sources-jar/jsMain/okio/FileSystem.kt
- \* /okio-3-0-0-sources-jar/nativeMain/okio/-PosixVariant.kt
- \* /okio-3-0-0-sources-jar/commonMain/okio/ForwardingFileSystem.kt
- \* /okio-3-0-0-sources-jar/nativeTest/okio/NativeSystemFileSystemTest.kt
- \* /okio-3-0-0-sources-jar/nonJvmMain/okio/internal/Hmac.kt
- \* /okio-3-0-0-sources-jar/nonJvmMain/okio/Path.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/FileSystemJavaTest.java
- \* /okio-3-0-0-sources-jar/unixMain/okio/-UnixPosixVariant.kt
- \* /okio-3-0-0-sources-jar/nativeMain/okio/FileSource.kt
- \*
- /okio-3-0-0-sources-jar/nonJvmMain/okio/HashingSink.kt
- \* /okio-3-0-0-sources-jar/linuxX64Main/okio/-LinuxX64PosixVariant.kt
- \* /okio-3-0-0-sources-jar/commonTest/okio/UnsafeCursorTest.kt
- \* /okio-3-0-0-sources-jar/appleMain/okio/-ApplePosixVariant.kt
- \* /okio-3-0-0-sources-jar/nativeMain/okio/PosixFileSystem.kt
- \* /okio-3-0-0-sources-jar/nonJvmMain/okio/HashingSource.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/internal/Hmac.kt
- \* /okio-3-0-0-sources-jar/nativeMain/okio/FileSink.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/JvmTest.kt
- \* /okio-3-0-0-sources-jar/appleMain/okio/ByteString.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/Path.kt
- \* /okio-3-0-0-sources-jar/mingwX64Main/okio/-WindowsPosixVariant.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/internal/HmacTest.kt
- \* /okio-3-0-0-sources-jar/appleTest/okio/AppleByteStringTest.kt
- \* /okio-3-0-0-sources-jar/jvmMain/okio/NioSystemFileSystem.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/ZipFileSystemJavaTest.java
- \* /okio-3-0-0-sources-jar/jvmMain/okio/JvmSystemFileSystem.kt
- \*
- /okio-3-0-0-sources-jar/commonMain/okio/FileSystem.kt
- \* /okio-3-0-0-sources-jar/jvmTest/okio/JvmSystemFileSystemTest.kt

## 1.22 protobuf-java 3.20.1

### 1.22.1 Available under license :

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Manifest-Version: 1.0

Automatic-Module-Name: com.google.protobuf

Bnd-LastModified: 1650575142706

Build-Jdk: 1.8.0\_181-google-v7

Built-By: haberman

Bundle-Description: Core Protocol Buffers library. Protocol Buffers are a way of encoding structured data in an efficient yet extensible format.

Bundle-DocURL: <https://developers.google.com/protocol-buffers/>  
Bundle-License: <https://opensource.org/licenses/BSD-3-Clause>  
Bundle-ManifestVersion: 2  
Bundle-Name: Protocol Buffers [Core]  
Bundle-SymbolicName: com.google.protobuf  
Bundle-Version: 3.20.1  
Created-By: Apache Maven Bundle Plugin  
Export-Package: com.google.protobuf;version="3.20.1"  
Import-Package: sun.misc;resolution:=optional,com.google.protobuf;version="[3.20,4)"  
Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.7))"  
Tool: Bnd-3.0.0.201509101326

Found in path(s):

\* /protobuf-java-3-20-1-3-jar/META-INF/MANIFEST.MF

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Found in path(s):

\* /protobuf-java-3-20-1-3-jar/google/protobuf/empty.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/source\_context.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/wrappers.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/any.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/descriptor.proto  
\*  
/protobuf-java-3-20-1-3-jar/google/protobuf/struct.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/timestamp.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/api.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/compiler/plugin.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/type.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/duration.proto  
\* /protobuf-java-3-20-1-3-jar/google/protobuf/field\_mask.proto

## 1.23 constraintlayout 2.1.4



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 */
```

Found in path(s):

```
/*
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewOscillator.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/MotionEvent.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ReactiveGuide.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/ViewTransition.java
 *
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewTimeCycle.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MotionButton.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewSpline.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/ViewTransitionController.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/FloatLayout.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MotionLabel.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/SharedValues.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/Carousel.java
 * /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionHelperInterface.java
 */
```

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 */
```

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Found in path(s):

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintLayout.java  
\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Guideline.java

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\*/

Found in path(s):

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintAttribute.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Constraints.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Placeholder.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Barrier.java

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Found in path(s):

- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/TransitionAdapter.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/OnSwipe.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Group.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/MotionPlaceholder.java
- \*
- /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/Layer.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionHelper.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MockView.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintHelper.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewState.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/CircularFlow.java

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\*/

Found in path(s):

- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/TransitionBuilder.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/Flow.java
- \* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionInterpolator.java

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\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintSet.java

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\*/

Found in path(s):

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/Animatable.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintsChangedListener.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionLayout.java

\*

/constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyTimeCycle.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyPosition.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyTrigger.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyFrames.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionScene.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/Key.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/TouchResponse.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintProperties.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/Debug.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/ImageFilterView.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyCycle.java

\*

/constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MotionTelltale.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/StateSet.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyPositionBase.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/StopLogic.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionController.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/VirtualLayout.java

\* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/DesignTool.java

```

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyAttributes.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/ImageFilterButton.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionPaths.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintLayoutStates.java
*
/constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/CustomFloatAttributes.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionConstrainedPoint.java

```

## 1.24 safestring 2.0

### 1.24.1 Available under license :

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```

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* safe_mem_lib.h -- Safe C Library Memory APIs
*
* October 2008, Bo Berry
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*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/include/safe_mem_lib.h

```

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```

/*-----
* strljustify_s.c

```

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\* November 2008, Bo Berry  
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Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strljustify\_s.c  
No license file was found, but licenses were detected in source scan.

/\*-----  
\* mem\_primitives\_lib.c - Unguarded Memory Copy Routines  
\*  
\* February 2005, Bo Berry  
\*  
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\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/mem\_primitives\_lib.c  
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/\*-----

```

* strcasestr_s.c
*
* November 2008, Bo Berry
*
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*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/src/safe_string/strcasestr_s.c
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```

```

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* safe_string.h
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*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/include/safe_string.h
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```

```

/*-----
* strstr_s.c
*

```

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\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strstr\_s.c  
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/\*-----  
\* safe\_mem\_constraint.h  
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\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/safe\_mem\_constraint.h  
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/\*-----  
\* stremovevs\_s.c  
\*  
\* November 2008, Bo Berry



```

*
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*-----
*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/src/safe_string/stremovews_s.c
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```

```

/*-----
* strzero_s.c
*
* October 2008, Bo Berry
*
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*
*-----
*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/src/safe_string/strzero_s.c
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```

```

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* mem_primitives_lib.h - Unguarded Memory Copy Routines
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/\*-----  
\* strcat\_s.c  
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Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strcat\_s.c  
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/\*-----  
\* strispassword\_s.c  
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\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strispassword\_s.c  
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- \* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/safe\_str\_constraint.h

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```
/*-----
 * strlastsame_s.c
 *
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 *
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 *-----
 */
```

Found in path(s):

- \* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strlastsame\_s.c

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 * safe_limits.h -- limits include for portability
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 * February 2009, Bo Berry
 *
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 \*/

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/include/safe\_limits.h

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/\*-----  
 \* strlastchar\_s.c  
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 \* November 2008, Bo Berry  
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Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strlastchar\_s.c

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/\*-----  
 \* strncat\_s.c  
 \*  
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Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strncat\_s.c

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```
/*-----  
* strcpyfldin_s.c  
*  
* November 2008, Bo Berry  
*  
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*/
```

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strcpyfldin\_s.c  
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```
/*-----  
* strisuppercase_s.c  
*  
* October 2008, Bo Berry  
*  
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*-----  
*/
```

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strisuppercase\_s.c  
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```
/*-----  
* strislowercase_s.c  
*  
* February 2005, Bo Berry  
*  
* Copyright (c) 2008-2010, 2013 by Cisco Systems, Inc.  
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*-----  
*/
```

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\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strislowercase\_s.c  
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/*-----  
* safe_types.h -- types include for portability  
*  
* March 2007, Bo Berry  
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*  
*/
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Found in path(s):

- \* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/include/safe\_types.h

No license file was found, but licenses were detected in source scan.

```
/*-----
 * strprefix_s.c
 *
 * November 2008, Bo Berry
 *
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 * All rights reserved
 *-----
 */
```

Found in path(s):

- \* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strprefix\_s.c

No license file was found, but licenses were detected in source scan.

```
/*-----
 * safe_lib.h -- library include for portability
 *
 * February 2009, Bo Berry
 *
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*-----
*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/include/safe_lib.h
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```

```

/*-----
* strncpy_s.c
*
* October 2008, Bo Berry
*
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* All rights Reserved.
*-----
*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/src/safe_string/strncpy_s.c
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```

```

/*-----
* strishex_s.c
*
* October 2008, Bo Berry
*
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*/

```

Found in path(s):

```

* /safe-lib-2-0-1-tar-gz/safe_lib_2_0/src/safe_string/strishex_s.c

```

No license file was found, but licenses were detected in source scan.

```
/*-----  
* safe_str_lib.h -- Safe C Library String APIs  
*  
* October 2008, Bo Berry  
*  
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*-----  
*/
```

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/include/safe\_str\_lib.h

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```
/*-----  
* strspn_s.c  
*  
* November 2008, Bo Berry  
*  
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*-----  
*/
```

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strspn\_s.c



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```
/*-----  
* strpbrk_s.c  
*  
* November 2008, Bo Berry  
*  
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*-----  
*/
```

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strpbrk\_s.c

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```
/*-----  
* strtok_s.c  
*  
* October 2008, Bo Berry  
*  
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*-----  
*/
```

Found in path(s):

\* /safe-lib-2-0-1-tar-gz/safe\_lib\_2\_0/src/safe\_string/strtok\_s.c

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 */
```

Found in path(s):

```
* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/ToggleView.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/dialog/MaterialAlertDialog.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/FloatingActionMode.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/OverflowListView.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/dialog/MaterialDialogFragment.java
*
/appcompat-1-6-0-sources-jar/com/am/appcompat/widget/ShapeableImageView.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/PendingIntentCompat.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/LayoutParams.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/dialog/MaterialDialog.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/ToolbarDelegate.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/storage/StorageManagerCompat.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/storage/StorageVolumeCompat.java
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* /appcompat-1-6-0-sources-jar/com/am/appcompat/graphics/CanvasCompat.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/os/BundleCompat.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/widget/AppCompatImageView.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/dialog/MaterialDialogHelper.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/widget/DividerItemDecoration.java
*
/appcompat-1-6-0-sources-jar/com/am/appcompat/view/MenuListView.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/MainLayout.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/dialog/MaterialAlertDialogFragment.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/MenuItemView.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/widget/ImageViewHelper.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/BackPressedDelegate.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/ApplicationCompat.java
* /appcompat-1-6-0-sources-jar/com/am/appcompat/widget/AppCompatImageButton.java
```



\* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/ToggleLayout.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/FloatingPopupWindow.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/BoundsAdapter.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/view/BackgroundLayout.java  
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\* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/Fragment.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/ApplicationHolder.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/AppCompatDialogFragment.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/AppCompatAlertDialogFragment.java  
\* /appcompat-1-6-0-sources-jar/com/am/appcompat/app/AppCompatActivity.java

## 1.27 gson 2.10.1

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Manifest-Version: 1.0  
Created-By: 11.0.16.1 (Azul Systems, Inc.)  
Build-Jdk-Spec: 11  
Bnd-LastModified: 1673019830620  
Bundle-ContactAddress: <https://github.com/google/gson>  
Bundle-Description: Gson JSON library  
Bundle-Developers: google;organization=Google;organizationUrl="https://www.google.com"  
Bundle-DocURL: <https://github.com/google/gson/gson>  
Bundle-License: "Apache-2.0";link="https://www.apache.org/licenses/LICENSE-2.0.txt"  
Bundle-ManifestVersion: 2  
Bundle-Name: Gson

Bundle-RequiredExecutionEnvironment: JavaSE-1.7, JavaSE-1.8  
Bundle-SCM: url="https://github.com/google/gson/gson/",connection="scm:git:https://github.com/google/gson.git/gson",developer-connection="scm:git:git@github.com:google/gson.git/gson",tag="gson-parent-2.10.1"  
Bundle-SymbolicName: com.google.gson  
Bundle-Vendor: Google Gson Project  
Bundle-Version: 2.10.1  
Export-Package: com.google.gson;uses:="com.google.gson.reflect,com.google.gson.stream";version="2.10.1",com.google.gson.annotations;version="2.10.1",com.google.gson.reflect;version="2.10.1",com.google.gson.stream;version="2.10.1"  
Import-Package: sun.misc;resolution:=optional,com.google.gson.annotations  
Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.7))"  
Tool: Bnd-6.4.0.202211291949  
Multi-Release: true

Found in path(s):

\* /gson-2-10-1-jar/META-INF/MANIFEST.MF

## 1.28 okhttp 4.11.0

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## 1.31 firebase-messaging 31.4.0

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nav\_order: 1

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### ## New to Firebase?

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nav\_order: 5

---

## # Best Practices

---

parent: Best Practices

---

## # Dependency Injection

While [Firebase Components]({{ site.baseurl }}{% link components/components.md %}) provides basic Dependency Injection capabilities for interop between Firebase SDKs, it's not ideal as a general purpose DI framework for a few reasons, to name some:

- \* It's verbose, i.e. requires manually specifying dependencies and constructing instances of components in Component definitions.
- \* It has a runtime cost, i.e. initialization time is linear in the number of Components present in the graph

As a result using [Firebase Components]({{ site.baseurl }}{% link components/components.md %}) is appropriate only for inter-SDK injection and scoping instances per `FirebaseApp`.

On the other hand, manually instantiating SDKs is often tedious, errorprone, and leads to code smells that make code less testable and couples it to the implementation rather than the interface. For more context see [Dependency Injection](https://en.wikipedia.org/wiki/Dependency\_injection) and [Motivation](https://github.com/google/guice/wiki/Motivation).

{: .important }

It's recommended to use [Dagger](https://dagger.dev) for internal dependency injection within the SDKs and [Components]({{ site.baseurl }}{% link components/components.md %}) to inject inter-sdk dependencies that are available only at runtime into the [Dagger Graph](https://dagger.dev/dev-guide/#building-the-graph) via

[builder setters](https://dagger.dev/dev-guide/#binding-instances) or [factory arguments](https://dagger.dev/api/latest/dagger/Component.Factory.html).

See: [Dagger docs](https://dagger.dev)

See: [Dagger tutorial](https://dagger.dev/tutorial/)

```
{: .highlight }
```

While Hilt is the recommended way to use dagger in Android applications, it's not suitable for SDK/library development.

## ## How to get started

Since [Dagger](https://dagger.dev) does not strictly follow semver and requires the dagger-compiler version to match the dagger library version,

it's not safe to depend

on it via a pom level dependency, see [This comment](https://github.com/firebase/firebase-android-sdk/issues/1677#issuecomment-645669608) for context. For this reason in Firebase SDKs we "vendor/repackage" Dagger into the SDK itself under

``com.google.firebase.{sdkname}.dagger``. While it incurs in a size increase, it's usually on the order of a couple of KB and is considered negligible.

To use Dagger in your SDK use the following in your Gradle build file:

```
```groovy
plugins {
    id("firebase-vendor")
}

dependencies {
    implementation(libs.java.inject)
    vendor(libs.dagger.dagger) {
        exclude group: "javax.inject", module: "javax.inject"
    }
    annotationProcessor(libs.dagger.compiler)
}
```
```

## ## General Dagger setup

As mentioned in [Firebase Components]({{ site.baseurl }}{% link components/components.md %}), all components are scoped per ``FirebaseApp`` meaning there is a single instance of the component within a given ``FirebaseApp``.

This makes it a natural fit to get all inter-sdk dependencies and instantiate the Dagger component inside the ``ComponentRegistrar``.

```
```kotlin
```

```

class MyRegistrar : ComponentRegistrar {
    override fun getComponents() = listOf(
        Component.builder(MySdk::class.java)
            .add(Dependency.required(FirebaseOptions::class.java))
            .add(Dependency.optionalProvider(SomeInteropDep::class.java))
            .factory(c -> DaggerMySdkComponent.builder()
                .setFirebaseApp(c.get(FirebaseApp::class.java))
                .setSomeInterop(c.getProvider(SomeInteropDep::class.java))
                .build()
            ).getMySdk()
        ).build()
    }
}

```

Here's a simple way to define the dagger component:

```

```kotlin
@Component(modules = MySdkComponent.MainModule::class)
@Singleton
interface MySdkComponent {
    // Informs dagger that this is one of the types we want to be able to create
    // In this example we only care about MySdk
    fun getMySdk() : MySdk

    // Tells Dagger that some types are not available statically and in order to create the component
    // it needs FirebaseApp and Provider<SomeInteropDep>
    @Component.Builder
    interface Builder {
        @BindsInstance fun setFirebaseApp(app: FirebaseApp)
        @BindsInstance fun setSomeInterop(interop: com.google.firebase.inject.Provider<SomeInteropDep>)
        fun build() : MySdkComponent
    }
}

@Module
interface MainModule {
    // define module @Provides and @Binds here
}
}
```

```

The only thing left to do is to properly annotate `MySdk`:

```

```kotlin
@Singleton
class MySdk @Inject constructor(app: FirebaseApp, interopAdapter: MySdkAdapter) {
    fun someMethod() {
        interopAdapter.doInterop()
    }
}

```

```

}

@Singleton
class MySdkInteropAdapter @Inject constructor(private val interop:
com.google.firebase.inject.Provider<SomeInteropDep>) {
    fun doInterop() {
        interop.get().doStuff()
    }
}
}
```

```

## ## Scope

Unlike Component, Dagger does not use singleton scope by default and instead injects a new instance of a type at each injection point, in the example above we want `MySdk` and `MySdkInteropAdapter` to be singletons so they are annotated with `@Singleton`.

See [Scoped bindings](<https://dagger.dev/dev-guide/#singletons-and-scoped-bindings>) for more details.

## ### Support multiple instances of the SDK per `FirebaseApp` (multi-resource)

As mentioned in [Firebase Components]({{ site.baseurl }}{% link components/components.md %}), some SDKs support multi-resource mode, which effectively means that there are 2 scopes at play:

1. `@Singleton` scope that the main `MultiResourceComponent` has.
2. Each instance of the sdk will have its own scope.

```

```mermaid
flowchart LR
    subgraph FirebaseApp
        direction TB
        subgraph FirebaseComponents
            direction BT
            subgraph GlobalComponents[Outside of SDK]
                direction LR
                FirebaseOptions
                SomeInterop
                Executor["@Background Executor"]
            end
        end
    end

    subgraph DatabaseComponent["@Singleton DatabaseMultiDb"]
        direction TB
        subgraph Singleton["@Singleton"]

```



```

SomeImpl -.-> SomeInterop
    SomeImpl -.-> Executor
end

subgraph Default["@DbScope SDK(default)"]
    MainClassDefault[FirebaseDatabase] --> SomeImpl
    SomeOtherImplDefault[SomeOtherImpl] -.-> FirebaseOptions
    MainClassDefault --> SomeOtherImplDefault
end

subgraph MyDbName["@DbScope SDK(myDbName)"]
    MainClassMyDbName[FirebaseDatabase] --> SomeImpl
    SomeOtherImplMyDbName[SomeOtherImpl] -.-> FirebaseOptions
    MainClassMyDbName --> SomeOtherImplMyDbName
end

end
end
end

classDef green fill:#4db6ac
classDef blue fill:#1a73e8
class GlobalComponents green
class DatabaseComponent green
class Default blue
class MyDbName blue
```

```

As you can see above, `DatabaseMultiDb` and `SomeImpl` are singletons, while `FirebaseDatabase` and `SomeOtherImpl` are scoped per `database name`.

It can be easily achieved with the help of [Dagger's subcomponents](https://dagger.dev/dev-guide/subcomponents).

For  
example:

```

```kotlin
@Scope
annotation class DbScope

@Component(modules = DatabaseComponent.MainModule::class)
interface DatabaseComponent {
    fun getMultiDb() : DatabaseMultiDb

    @Component.Builder
    interface Builder {
        // usual setters for Firebase component dependencies
        // ...
        fun build() : DatabaseComponent
    }
}
```

```

```

@Module(subcomponents = DbInstanceComponent::class)
interface MainModule { }

@Module
@DbScope
interface DbInstanceComponent {
    fun factory() : Factory

    @Subcomponent.Factory
    interface Factory {
        fun create(@BindsInstance @Named("dbName") dbName: String)
    }
}

@Module
interface InstanceModule {
    // ...
}
}
...

```

Annotating `FirebaseDatabase`:

```

```kotlin
@DbScope
class FirebaseDatabase @Inject constructor(options: FirebaseOptions, @Named dbName: String) {
    // ...
}
...

```

Implementing  
`DatabaseMultiDb`:

```

```kotlin
@Singleton
class DatabaseMultiDb @Inject constructor(private val factory: DbInstanceComponent.Factory) {
    private val instances = mutableMapOf<String, FirebaseDatabase>()

    @Synchronized
    fun get(dbName: String) : FirebaseDatabase {
        if (!instances.containsKey(dbName)) {
            mInstances.put(dbName, factory.create(dbName))
        }
        return mInstances.get(dbName);
    }
}
}
...

```

---

parent: Onboarding

---

# Creating a new Firebase SDK

{: .no\_toc}

1. TOC

{:toc}

Want to create a new SDK in

[firebase/firebase-android-sdk](https://github.com/firebase/firebase-android-sdk)?

Read on.

{:toc}

## Repository layout and Gradle

[firebase/firebase-android-sdk](https://github.com/firebase/firebase-android-sdk)

uses a multi-project Gradle build to organize the different libraries it hosts.

As a consequence, each project/product within this repo is hosted under its own subdirectory with its respective build file(s).

```bash

firebase-android-sdk

buildSrc

appcheck

    firebase-appcheck

    firebase-appcheck-playintegrity

firebase-annotations

firebase-common

    firebase-common.gradle # note the name of the build file

    ktx

        ktx.gradle.kts # it can also be kts

build.gradle # root project build file.

```

Most commonly, SDKs are located as immediate child directories of the root

directory, with the directory name being the exact name of the Maven artifact ID

the

library will have once released. e.g. `firebase-common` directory

hosts code for the `com.google.firebase:firebase-common` SDK.

{: .warning }

Note that the build file name for any given SDK is not `build.gradle` or `build.gradle.kts`

but rather mirrors the name of the sdk, e.g.

`firebase-common/firebase-common.gradle` or `firebase-common/firebase-common.gradle.kts`.

All of the core Gradle build logic lives in `buildSrc` and is used by all SDKs.

SDKs can be grouped together for convenience by placing them in a directory of choice.

## ## Creating an SDK

Let's say you want to create an SDK named `firebase-foo`

1. Create a directory called `firebase-foo`.
1. Create a file `firebase-foo/firebase-foo.gradle.kts`.
1. Add `firebase-foo` line to `subprojects.cfg` at the root of the tree.

### Update `firebase-foo.gradle.kts` with the following content

```
<details open markdown="block">
<summary>
    firebase-foo.gradle.kts
</summary>
```kotlin
plugins {
    id("firebase-library")
    // Uncomment
    for Kotlin
    // id("kotlin-android")
}

firebaseLibrary {
    // enable this only if you have tests in `androidTest`.
    testLab.enabled = true
    publishSources = true
    publishJavadoc = true
}

android {
    val targetSdkVersion : Int by rootProject
    val minSdkVersion : Int by rootProject

    compileSdk = targetSdkVersion
    defaultConfig {
        namespace = "com.google.firebase.foo"
        // change this if you have custom needs.
        minSdk = minSdkVersion
        targetSdk = targetSdkVersion
        testInstrumentationRunner = "androidx.test.runner.AndroidJUnitRunner"
    }
}
```

```
testOptions.unitTests.isIncludeAndroidResources = true
}
```

```
dependencies {
    implementation(project(":firebase-common"))
    implementation(project(":firebase-components"))
}
```

```
...
```

```
</details>
```

### Create `src/main/AndroidManifest.xml` with the following content:

```
<details open markdown="block">
<summary>
    src/main/AndroidManifest.xml
</summary>
```xml
<?xml version="1.0" encoding="utf-8"?>
<!-- Copyright {{ 'now' |
date: "%Y" }} Google LLC -->
<!-- -->
<!-- Licensed under the Apache License, Version 2.0 (the "License"); -->
<!-- you may not use this file except in compliance with the License. -->
<!-- You may obtain a copy of the License at -->
<!-- -->
<!-- http://www.apache.org/licenses/LICENSE-2.0 -->
<!-- -->
<!-- Unless required by applicable law or agreed to in writing, software -->
<!-- distributed under the License is distributed on an "AS IS" BASIS, -->
<!-- WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. -->
<!-- See the License for the specific language governing permissions and -->
<!-- limitations under the License. -->

<manifest xmlns:android="http://schemas.android.com/apk/res/android">
<application>
    <service android:name="com.google.firebase.components.ComponentDiscoveryService"
        android:exported="false">
        <meta-data
            android:name="com.google.firebase.components:com.google.firebase.foo.FirebaseFooRegistrar"

            android:value="com.google.firebase.components.ComponentRegistrar" />
        </service>
    </application>
</manifest>
```
</details>
```

### Create `com.google.firebase.foo.FirebaseFoo`

For Kotlin

<details open markdown="block">

<summary>

src/main/kotlin/com/google/firebase/foo/FirebaseFoo.kt

</summary>

```
```kotlin
```

```
class FirebaseFoo {
```

```
    companion object {
```

```
        @JvmStatic
```

```
        val instance: FirebaseFoo
```

```
        get() = getInstance(Firebase.app)
```

```
        @JvmStatic fun getInstance(app: FirebaseApp): FirebaseFoo = app.get(FirebaseFoo::class.java)
```

```
    }
```

```
}
```

```
```
```

</details>

For Java

<details markdown="block">

<summary>

src/main/java/com/google/firebase/foo/FirebaseFoo.java

</summary>

```
```java
```

```
public class FirebaseFoo {
```

```
    public static FirebaseFoo getInstance() {
```

```
        return getInstance(FirebaseApp.getInstance());
```

```
    }
```

```
    public static FirebaseFoo getInstance(FirebaseApp app) {
```

```
        return app.get(FirebaseFoo.class);
```

```
    }
```

```
}
```

```
```
```

</details>

### Create `com.google.firebase.foo.FirebaseFooRegistrar`

For

Kotlin

<details open markdown="block">

<summary>

src/main/kotlin/com/google/firebase/foo/FirebaseFooRegistrar.kt

</summary>

{: .warning }

You should strongly consider using [Dependency Injection]({{ site.baseurl }}{% link best\_practices/dependency\_injection.md %})

to instantiate your sdk instead of manually constructing its instance in the `factory()` below.

```kotlin

```
class FirebaseFooRegistrar : ComponentRegistrar {
    override fun getComponents() =
        listOf(
            Component.builder(FirebaseFoo::class.java).factory { container -> FirebaseFoo() }.build(),
            LibraryVersionComponent.create("fire-foo", BuildConfig.VERSION_NAME)
        )
}
```

</details>

For Java

<details markdown="block">

<summary>

src/main/java/com/google/firebase/foo/FirebaseFooRegistrar.java

</summary>

```java

```
public class FirebaseFooRegistrar implements ComponentRegistrar {
    @Override
    public List<Component<?>> getComponents() {
        return Arrays.asList(
            Component.builder(FirebaseFoo.class).factory(c
-> new FirebaseFoo()).build(),
            LibraryVersionComponent.create("fire-foo", BuildConfig.VERSION_NAME));
    }
}
```

</details>

Continue to [How Firebase works]({{ site.baseurl }}{% link how\_firebase\_works.md %}).

Test license

---

has\_children: true

permalink: /components/

nav\_order: 4

---

## # Firebase Components

{: .no\_toc}

### 1. TOC

{:toc}

Firebase is known for being easy to use and requiring no/minimal configuration at runtime.

Just adding SDKs to the app makes them discover each other to provide additional functionality, e.g. `Firestore` automatically integrates with `Auth` if present in the app.

- \* Firebase SDKs have required and optional dependencies on other Firebase SDKs
- \* SDKs have different initialization requirements, e.g. `Analytics` and `Crashlytics` must be initialized upon application startup, while some are initialized on demand only.

To accommodate these requirements Firebase uses a component model that discovers SDKs present in the app, determines their dependencies and provides them to dependent SDKs via a `Dependency Injection` mechanism.

This page describes the aforementioned Component Model, how it works and why it's needed.

## ## Design Considerations

### ### Transparent/invisible to 3p Developers

To

provide good developer experience, we don't want developers to think about how SDKs work and interoperate internally.

Instead we want our SDKs to have a simple API surface that hides all of the internal details.

Most products have an API surface that allows developers to get an instance of a given SDK via

`FirebaseFoo.getInstance()`

and start using it right away.

### ### Simple to use and integrate with for component developers

- \* The component model is lightweight in terms of integration effort. It is not opinionated on how components are structured.
- \* The component model should require as little cooperation from components runtime as possible.
- \* It provides component developers with an API that is easy to use correctly, and hard to use incorrectly.
- \* Does not sacrifice testability of individual components in isolation

### ### Performant at startup and initialization

The runtime does as little work as possible during initialization.

## ## What is a Component?

A Firebase Component



is an entity that:

- \* Implements one or more interfaces
- \* Has a list of dependencies(required or optional). See [Dependencies]({{ site.baseurl }}{% link components/dependencies.md %})
- \* Has initialization requirements(e.g. eager in default app)
- \* Defines a factory creates an instance of the components interface given it's dependencies.  
(In other words describes how to create the given component.)

Example:

```
```java
// Defines a component that is registered as both `FirebaseAuth` and `InternalAuthProvider`.
Component<FirebaseAuth> auth = Component.builder(FirebaseAuth.class, InternalAuthProvider.class)
    // Declares dependencies
    .add(Dependency.required(FirebaseOptions.class))
    // Defines a factory
    .factory(container -> new FirebaseAuth(container.get(FirebaseOptions.class)))
    .eagerInDefaultApp() // alwaysEager() or lazy(), lazy is the default.
    .build()
```
```

All components are singletons within a Component Container(e.g. one instance per FirebaseApp).

There are however

SDKs that need the ability to expose multiple objects per FirebaseApp, for example RTBD(as well as Storage and Firestore) has multodb support which allows developers to access one or more databases within one FirebaseApp. To address this requirement, SDKs have to register their components in the following form(or similar):

```
```java
// This is the singleton holder of different instances of FirebaseDatabase.
interface RtdbComponent {
    FirebaseDatabase getDefault();
    FirebaseDatabase get(String databaseName);
}
```
```

As you can see in the previous section, components are just values and don't have any behavior per se, essentially they are just blueprints of how to create them and what dependencies they need.

So there needs to be some ComponentRuntime that can discover and wire them together into a dependency graph, in order to do that, there needs to be an agreed upon location where SDKs can register the components they provide.

The next 2 sections describe how it's done.

## Component  
Registration

In order to define the `Components` an SDK provides, it needs to define a class that implements `ComponentRegistrar`,  
this class contains all component definitions the SDK wants to register with the runtime:

```
```java
public class MyRegistrar implements ComponentRegistrar {
    /// Returns a one or more Components that will be registered in
    /// FirebaseAuth and participate in dependency resolution and injection.
    @Override
    public Collection<FirebaseComponent<?>> getComponents() {
        Arrays.asList(Component.builder(MyType.class)
            /* ... */
            .build());
    }
}
```
```

## ## Component Discovery

In addition to creating the `ComponentRegistrar` class, SDKs also need to add them to their `AndroidManifest.xml` under `ComponentDiscoveryService`:

```
```xml
<manifest xmlns:android="http://schemas.android.com/apk/res/android">
<application>
    <service android:name="com.google.firebase.components.ComponentDiscoveryService"
        android:exported="false">

        <meta-data
            android:name="com.google.firebase.components:com.google.firebase.foo.FirebaseFooRegistrar"
            android:value="com.google.firebase.components.ComponentRegistrar" />
    </service>
</application>
</manifest>
```
```

When the final app is built, manifest registrar entries will all end up inside the above `service` as metadata key-value pairs.

At this point `FirebaseApp` will instantiate them and use the `ComponentRuntime` to construct the component graph.

## ## Dependency resolution and initialization

### ### Definitions and constraints

\* \*\*Component A depends on Component B\*\* if `B` depends on an `interface` that `A` implements.  
\* \*\*For any Interface I, only one component is allowed to implement I\*\* (with the exception of  
[Set Dependencies]({{ site.baseurl }}{% link components/dependencies.md %}#set-dependencies)). If this

invariant is violated, the container will

fail to start at runtime.

**\*\*There must not be any dependency cycles\*\*** among components.

See Dependency Cycle Resolution on how this limitation can be mitigated

**\*\*Components are initialized lazily by default\*\***(unless a component is declared eager) and are initialized when requested

by an application either directly or transitively.

The initialization phase of the FirebaseApp will consist of the following steps:

1. Get a list of available FirebaseComponents that were discovered by the Discovery mechanism
2. Topologically sort components based on their declared dependencies - failing if a dependency cycle is detected or multiple implementations are registered for any interface.
3. Store a map of {iface -> ComponentFactory} so that components can be instantiated on demand(Note that component instantiation does not yet happen)
4. Initialize EAGER components or schedule them to initialize on device unlock, if in direct boot mode.

### Initialization example

Below is an example illustration of the state of the component graph after initialization:

```mermaid

flowchart

TD

```
Analytics --> Installations
Auth --> Context
Auth --> FirebaseOptions
Context[android.os.Context]
Crashlytics --> Installations
Crashlytics --> FirebaseApp
Crashlytics --> FirebaseOptions
Crashlytics -.-> Analytics
Crashlytics --> Context
Database -.-> Auth
Database --> Context
Database --> FirebaseApp
Database --> FirebaseOptions
Firestore -.-> Auth
Messaging --> Installations
Messaging --> FirebaseOptions
Messaging --> Context
RemoteConfig --> FirebaseApp
RemoteConfig --> Context
RemoteConfig --> Installations
```

classDef eager fill:#4db66e,stroke:#4db6ac,color:#000;

```

classDef transitive fill:#4db6ac,stroke:#4db6ac,color:#000;
classDef always fill:#1a73e8,stroke:#7baaf7,color:#fff;

class Analytics eager
class Crashlytics eager
class Context always
class FirebaseOptions always
class FirebaseApp always
class Installations transitive
```

```

There are **2**

explicitly eager components in this example: `Crashlytics` and `Analytics`.

These components are initialized when `FirebaseApp` is initialized. `Installations` is initialized eagerly because eager components depends on it (see Prefer Lazy dependencies to avoid this as much as possible).

`FirebaseApp`, `FirebaseOptions` and `Android Context` are always present in the Component Container and are considered initialized as well.

\*The rest of the components are left uninitialized and will remain so until the client application requests them or an eager

component initializes them by using a Lazy dependency.\*

For example, if the application calls `FirebaseDatabase.getInstance()`, the container will initialize `Auth` and `Database`

and will return `Database` to the user.

### Support multiple instances of the SDK per `FirebaseApp` (multi-resource)

Some SDKs support multi-resource mode of operation, where it's possible to create more than one instance per `FirebaseApp`.

Examples:

\* RTDB allows

more than one database in a single Firebase project, so it's possible to instantiate one instance of the sdk per database

```

```kotlin
val rtdbOne = Firebase.database(app) // uses default database
val rtdbTwo = Firebase.database(app, "dbName")
```

```

\* Firestore, functions, and others support the same usage pattern

To allow for that, such SDKs register a singleton "MultiResource" [Firebase component]({{ site.baseurl }}{% link components/components.md %}),

which creates instances per resource (e.g. db name).

Example

```

```kotlin
class DatabaseComponent(private val app: FirebaseApp, private val tokenProvider: InternalTokenProvider) {
    private val instances: MutableMap<String, FirebaseDatabase> = new HashMap<>();

    @Synchronized
    fun get(dbName: String) : FirebaseDatabase {
        if (!instances.containsKey(dbName)) {
            instances.put(dbName, FirebaseDatabase(app, tokenProvider, dbName))
        }
        return instances.get(dbName);
    }
}

```

```

class FirebaseDatabase(
    app: FirebaseApp,
    tokenProvider:
InternalTokenProvider,
    private val String dbName)

    companion object {
        fun getInstance(app : FirebaseApp) = getInstance("default")
        fun getInstance(app : FirebaseApp, dbName: String) =
            app.get(DatabaseComponent::class.java).get("default")
    }
}

```

...

title: Contributor documentation

description: Documentation and best practices for Android SDK development

logo: "https://firebase.google.com/downloads/brand-guidelines/SVG/logo-logomark.svg"

remote\_theme: just-the-docs/just-the-docs@v0.4.0.rc3

plugins:

- jekyll-remote-theme

color\_scheme: light

# Aux links for the upper right navigation

aux\_links:

"SDK Github Repo":

- "//github.com/firebase/firebase-android-sdk"

# Enable or disable the site search

# Supports true (default) or false

search\_enabled: true

search:

# Split pages into sections that can be searched individually

# Supports 1 - 6, default: 2

heading\_level: 6

```

# Maximum amount of previews per search result
# Default: 3
previews: 2
# Maximum amount of words to display before a matched word in the preview
# Default: 5
preview_words_before: 3
# Maximum amount of words to display after a matched word in the preview
# Default: 10
preview_words_after: 3
# Set the search token separator
# Default: /[s\~]/+
# Example: enable support for hyphenated search words
tokenizer_separator: /[s/]+/
# Display the relative url in search results
# Supports true (default) or false
rel_url: true
# Enable or disable the search button that appears in the bottom right corner of every page
# Supports true or false (default)
button: false

mermaid:
# Version of mermaid library
# Pick an available version from https://cdn.jsdelivr.net/npm/mermaid/
version: "9.2.2"
# Put any additional configuration, such as setting the theme, in _includes/mermaid_config.js

# Enable or disable heading anchors
heading_anchors: true
permalink: pretty

callouts_level: quiet
callouts:
highlight:
  color: yellow
important:
  title: Important
  color: blue
new:
  title: New
  color: green
note:
  title: Note
  color: purple
warning:
  title: Warning
  color: red

# Back to top link

```

```

back_to_top: true
back_to_top_text: "Back to top"

# Footer last edited timestamp
last_edit_timestamp:
  true # show or hide edit time - page must have `last_modified_date` defined in the frontmatter
last_edit_time_format: "%b %e %Y at %I:%M %p" # uses ruby's time format: https://ruby-doc.org/stdlib-2.7.0/libdoc/time/rdoc/Time.html

# Footer "Edit this page on GitHub" link text
gh_edit_link: true # show or hide edit this page link
gh_edit_link_text: "Edit this page on GitHub"
gh_edit_repository: "https://github.com/firebase/firebase-android-sdk" # the github URL for your repo
gh_edit_branch: "master" # the branch that your docs is served from
gh_edit_source: "contributor-docs" # the source that your files originate from
gh_edit_view_mode: "edit" # "tree" or "edit" if you want the user to jump into the editor immediately
name: Copyright check

on: pull_request

concurrency:
  group: ${{ github.workflow }}-${{ github.event.pull_request.number || github.ref }}
  cancel-in-progress: true

jobs:
  copyright-check:
    runs-on: ubuntu-22.04
    steps:
      - uses: actions/checkout@v3.0.2
      - uses: actions/setup-python@v2
        with:
          python-version: '3.9'
      - run: |
          pip install -e "ci/fireci"
      - run: |
          fireci copyright_check \
            -e py \
            -e gradle \
            -e java \
            -e kt \
            -e groovy \
            -e sh \
            -e proto
    ---
  parent: Firebase Components
  ---

```

# Dynamic Module Support

TODO

---

parent: Firebase Components

---

# Executors

{: .no\_toc}

1. TOC

{:toc}

## Intro

OS threads are a limited resource that needs to be used with care. In order to minimize the number of threads used by Firebase

as a whole and to increase resource sharing Firebase Common provides a set of standard

[executors](<https://developer.android.com/reference/java/util/concurrent/Executor>)

and [coroutine dispatchers](<https://kotlinlang.org/api/kotlinx.coroutines/kotlinx-coroutines-core/kotlinx.coroutines/-coroutine-dispatcher/>)

for use by all Firebase SDKs.

These executors are available as components and can be requested by product SDKs as component dependencies.

Example:

```
```java
public class MyRegistrar implements ComponentRegistrar {
    public List<Component<?>> getComponents() {
        Qualified<Executor> backgroundExecutor = Qualified.qualified(Background.class, Executor.class);
        Qualified<ExecutorService> liteExecutorService = Qualified.qualified(Lightweight.class, ExecutorService.class);

        return Collections.singletonList(
            Component.builder(MyComponent.class)
                .add(Dependency.required(backgroundExecutor))
                .add(Dependency.required(liteExecutorService))
                .factory(c -> new MyComponent(c.get(backgroundExecutor), c.get(liteExecutorService)))
                .build());
    }
}
```
```

All executors(with the exception of `@UiThread`) are available as the following interfaces:

\* `Executor`

\* `ExecutorService`

\* `ScheduledExecutorService`



\* `CoroutineDispatcher`

`@UiThread` is provided only as a plain `Executor`.

### ### Validation

All SDKs have a custom linter check that detects creation of thread pools and threads, this is to ensure SDKs use the above executors instead of creating their own.

### ## Choose the right executor

Use the following diagram to pick the right executor for the task you have at hand.

```
```mermaid
graph TD
    Start[Start] --> DoesBlock{Does it block?}
    DoesBlock -->|No| NeedUi{Does it need to run on UI thread?}
    DoesBlock -->|Yes| UiExecutor[UiExecutor]
    NeedUi -->|Yes| UiExecutor
    NeedUi -->|No| TakesLong{Does it take more than 10ms to execute?}
    TakesLong -->|Yes| BgExecutor[BgExecutor]
    TakesLong -->|No| LiteExecutor[LiteExecutor]
    BgExecutor --> DoesBlockDiskIO{Does it block only on disk IO?}
    DoesBlockDiskIO -->|Yes| BgExecutor
    DoesBlockDiskIO -->|No| BlockExecutor[BlockExecutor]
```

```
classDef start fill:#4db6ac,stroke:#4db6ac,color:#000;
```

```
class Start start
```

```
classDef condition fill:#f8f9fa,stroke:#bdc1c6,color:#000;
```

```
class DoesBlock condition;
```

```
class NeedUi condition;
```

```
class TakesLong condition;
```

```
class DiskIO condition;
```

```
classDef executor fill:#1a73e8,stroke:#7baaf7,color:#fff;
```

```
class UiExecutor executor;
```

```
class LiteExecutor executor;
```

```
class BgExecutor executor;
```

```
class BlockExecutor executor;
```

```
```
```

### ### UiThread

Used to schedule tasks on application's UI thread, internally it uses a Handler to post runnables onto the main looper.

Example:

```
```java
//
Java
Qualified<Executor> uiExecutor = qualified(UiThread.class, Executor.class);
```

```kotlin
// Kotlin
Qualified<CoroutineDispatcher> dispatcher = qualified(UiThread::class.java, CoroutineDispatcher::class.java);
```
```

### ### Lightweight

Use for tasks that never block and don't take too long to execute. Backed by a thread pool of N threads where N is the amount of parallelism available on the device (number of CPU cores)

Example:

```
```java
// Java
Qualified<Executor> liteExecutor = qualified(Lightweight.class, Executor.class);
```

```kotlin
// Kotlin
Qualified<CoroutineDispatcher> dispatcher = qualified(Lightweight::class.java, CoroutineDispatcher::class.java);
```
```

### ### Background

Use for tasks that may block on disk IO (use `@Blocking` for network IO or blocking on other threads). Backed by 4 threads.

Example:

```
```java
// Java
Qualified<Executor> bgExecutor = qualified(Background.class, Executor.class);
```

```kotlin
// Kotlin
Qualified<CoroutineDispatcher> dispatcher
= qualified(Background::class.java, CoroutineDispatcher::class.java);
```
```

### ### Blocking

Use for tasks that can block for arbitrary amounts of time, this includes network IO.

Example:

```
```java
// Java
Qualified<Executor> blockingExecutor = qualified(Blocking.class, Executor.class);
```

```kotlin
// Kotlin
Qualified<CoroutineDispatcher> dispatcher = qualified(Blocking::class.java, CoroutineDispatcher::class.java);
```
```

### ### Other executors

#### #### Direct executor

{: .warning }

Prefer `@Lightweight` instead of using direct executor as it could cause dead locks and stack overflows.

For any trivial tasks that don't need to run asynchronously

Example:

```
```kotlin
FirebaseExecutors.directExecutor()
```
```

#### #### Sequential Executor

When you need an executor that runs tasks sequentially and guarantees any memory access is synchronized prefer to use a sequential executor instead of creating a `newSingleThreadedExecutor()`.

Example:

```
```java
// Pick the appropriate underlying executor using the
// chart above
Qualified<Executor> bgExecutor = qualified(Background.class, Executor.class);
// ...
Executor sequentialExecutor = FirebaseExecutors.newSequentialExecutor(c.get(bgExecutor));
```
```

### ## Proper Kotlin usage

A `CoroutineContext` should be preferred when possible over an explicit `Executor` or `CoroutineDispatcher`. You should only use an `Executor` at the highest (or inversely the lowest) level of your implementations. Most classes should not be concerned with the existence of an `Executor`.

Keep in mind that you can combine `CoroutineContext` with other `CoroutineScope` or `CoroutineContext`. And that all `suspend` functions inherit their `coroutineContext`:

```
```kotlin
suspend fun createSession(): Session {
    val context = backgroundDispatcher.coroutineContext + coroutineContext
    return Session(context)
}
```
```

To learn more, you should give the following Kotlin wiki page a read:

[Coroutine context and dispatchers](<https://kotlinlang.org/docs/coroutine-context-and-dispatchers.html#dispatchers-and-threads>)

##

Testing

### Using Executors in tests

`@Lightweight` and `@Background` executors have `StrictMode` enabled and throw exceptions on violations. For example trying to do Network IO on either of them will throw.

With that in mind, when it comes to writing tests, prefer to use the common executors as opposed to creating your own thread pools. This will ensure that your code uses the appropriate executor and does not slow down all of Firebase by using the wrong one.

To do that, you should prefer relying on Components to inject the right executor even in tests. This will ensure your tests are always using the executor that is actually used in your SDK build. If your SDK uses Dagger, see [Dependency Injection]({{ site.baseurl }}{% link best\_practices/dependency\_injection.md %}) and [Dagger's testing guide](<https://dagger.dev/dev-guide/testing>).

When the above is not an option, you can use `TestOnlyExecutors`, but make sure you're testing your code with the same executor that is used in production code:

```
```kotlin
dependencies {
    // ...
    testImplementation(project(":integ-testing"))
    // or
    androidTestImplementation(project(":integ-testing"))
}
```
```

```

This gives access to

```
```java
TestOnlyExecutors.ui();
TestOnlyExecutors.background();
TestOnlyExecutors.blocking();
TestOnlyExecutors.lite();
```
```

### ### Policy violations in tests

Unit tests require [Robolectric](<https://github.com/robolectric/robolectric>) to function correctly, and this comes with a major drawback; no policy validation.

Robolectric supports `StrictMode` - but does not provide the backing for its policy mechanisms to fire on violations. As such, you'll be able to do things like using `TestOnlyExecutors.background()` to execute blocking actions; usage that would have otherwise crashed in a real application.

Unfortunately, there is no easy way to fix this for unit tests. You can get around the issue by moving the tests to an emulator (integration tests)- but those can

be more expensive than your standard unit test, so you may want to take that into consideration when planning your testing strategy.

### ### StandardTestDispatcher support

The [kotlin.coroutines.test](<https://kotlin.github.io/kotlinx.coroutines/kotlinx-coroutines-test/>) library provides support for a number of different mechanisms in tests. Some of the more famous features include:

- [advanceUntilIdle](<https://kotlin.github.io/kotlinx.coroutines/kotlinx-coroutines-test/kotlinx.coroutines.test/-test-coroutine-scheduler/advance-until-idle.html>)
- [advanceTimeBy](<https://kotlin.github.io/kotlinx.coroutines/kotlinx-coroutines-test/kotlinx.coroutines.test/-test-coroutine-scheduler/advance-time-by.html>)
- [runCurrent](<https://kotlin.github.io/kotlinx.coroutines/kotlinx-coroutines-test/kotlinx.coroutines.test/-test-coroutine-scheduler/run-current.html>)

These features are all backed by `StandardTestDispatcher`, or more appropriately, the `TestScope` provided in a `runTest` block.

Unfortunately,

`TestOnlyExecutors` does not natively bind with `TestScope`.

Meaning, should you use `TestOnlyExecutors` in your tests- you won't be able to utilize the features provided by `TestScope`:

```

```kotlin
@Test
fun doesStuff() = runTest {
    val scope = CoroutineScope(TestOnlyExecutors.background().asCoroutineDispatcher())
    scope.launch {
        // ... does stuff
    }

    runCurrent() // doesn't invoke scope ??
}
```

```

To help fix this, we provide an extension method on `TestScope` called `firebaseExecutors`. It facilitates the binding of `TestOnlyExecutors` with the current `TestScope`.

For example, here's how you could use this extension method in a test:

```

```kotlin
@Test
fun doesStuff() = runTest {
    val scope = CoroutineScope(firebaseExecutors.background)
    scope.launch {
        // ... does stuff
    }

    runCurrent()
}
```
---
nav_order: 3
---

```

## # How Firebase Works

### ## Background

#### ### Eager Initialization

One of the biggest strengths for Firebase clients is the ease of integration. In a common case, a developer has very few things to do to integrate with Firebase. There is no need to initialize/configure Firebase at runtime. Firebase automatically initializes at application start and begins providing value to developers. A few notable examples:

- \* `Analytics` automatically tracks app events
- \* `Firebase Performance` automatically tracks app startup time, all network requests and screen performance
- \* `Crashlytics` automatically captures all application crashes, ANRs and non-fatals

This feature makes onboarding and adoption very simple. However, comes with the great responsibility of keeping

the application snappy. We shouldn't slow down application startup for 3p developers as it can stand in the way of user adoption of their application.

### ### Automatic Inter-Product Discovery

When present together in an application, Firebase products can detect each other and automatically provide additional functionality to the developer, e.g.:

- \* `Firestore` automatically detects `Auth` and `AppCheck` to protect read/write access to the database
- \* `Crashlytics` integrates with `Analytics`, when available, to provide additional insights into the application behavior and enables safe app rollouts

### ## FirebaseApp at the Core of Firebase

Regardless of what Firebase SDKs are present in the app, the main initialization point of Firebase is `FirebaseApp`. It acts as a container for all SDKs, manages their configuration, initialization and lifecycle.

### ### Initialization

`FirebaseApp` gets initialized with the help of `FirebaseApp.initializeApp()`. This happens [automatically at app startup](https://firebase.blog/posts/2016/12/how-does-firebase-initialize-on-android) or manually by the developer.

During initialization, `FirebaseApp` discovers all Firebase SDKs present in the app, determines the dependency graph between products(for inter-product functionality) and initializes `eager` products that need to start immediately, e.g. `Crashlytics` and `FirebasePerformance`.

### ### Firebase Configuration

`FirebaseApp` contains Firebase configuration for all products to use, namely `FirebaseOptions`, which tells Firebase which `Firebase` project to talk to, which real-time database to use, etc.

### ### Additional Services/Components

In addition to `FirebaseOptions`, `FirebaseApp` registers additional components that product SDKs can request via dependency injection. To name a few:

- \* `android.content.Context` (Application context)
- \* [Common Executors]({{ site.baseurl }}{% link components/executors.md %})
- \* `FirebaseOptions`
- \* Various internal components

### ## Discovery and Dependency Injection

There are multiple considerations that lead to the current design of how Firebase SDKs initialize.

1. Certain SDKs need to initialize at app startup.
2. SDKs have optional dependencies on other products that

get enabled when the developer adds the dependency to their app.

To enable this functionality, Firebase uses a runtime discovery and dependency injection framework [firebase-components](<https://github.com/firebase/firebase-android-sdk/tree/master/firebase-components>).

To integrate with this framework SDKs register the components they provide via a `ComponentRegistrar` and declare any dependencies they need to initialize, e.g.

```
```java
public class MyRegistrar implements ComponentRegistrar {
    @Override
    public List<Component<?>> getComponents() {
        return Arrays.asList(
            // declare the component
            Component.builder(MyComponent.class)
                // declare dependencies
                .add(Dependency.required(Context.class))
                .add(Dependency.required(FirebaseOptions.class))
                .add(Dependency.optionalProvider(InternalAuthProvider.class))
                // let the runtime know how to create your component.
                .factory(
                    diContainer
->
                    new MyComponent(
                        diContainer.get(Context.class),
                        diContainer.get(FirebaseOptions.class),
                        diContainer.get(InternalAuthProvider.class)))
                .build());
    }
}
```
```

This registrar is then registered in `AndroidManifest.xml` of the SDK and is used by `FirebaseApp` to discover all components and construct the dependency graph.

More details in [Firebase Components]({{ site.baseurl }}{% link components/components.md %}).

---

parent: Onboarding

---

## # Development Environment Setup

This page describes software and configuration required to work on code in the [Firebase/firebase-android-sdk](<https://github.com/firebase/firebase-android-sdk>) repository.

{:toc}



## ## JDK

The currently required version of the JDK is `11`. Any other versions are unsupported and using them could result in build failures.

## ## Android Studio

In general, the most recent version of Android Studio should work. The version that is tested at the time of this writing is `Dolphin | 2021.3.1`.

Download it here:

[Download Android Studio](https://developer.android.com/studio)

## ## Emulators

If you plan to run tests on emulators(you should), you should be able to install them directly from Android Studio's AVD manager.

## ## Github (Googlers Only)

To onboard and get write access to the github repository you need to have a github account fully linked with [go/github](http://go/github).

File a bug using this

[bug template](http://b/issues/new?component=312729&template=1016566)

and wait

for access to be granted.

After that configure github keys as usual using this

[Github documentation page](https://docs.github.com/en/github/authenticating-to-github/connecting-to-github-with-ssh).

## ## Importing the repository

1. Clone the repository with `git clone --recurse-submodules git@github.com:firebase/firebase-android-sdk.git`.
1. Open Android Studio and click "Open an existing project".  
![Open an existing project](as\_open\_project.png)
1. Find the `firebase-android-sdk` directory and open.
1. To run integration/device tests you will need a `google-services.json` file.

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---

has\_children: true

permalink: /onboarding/

nav\_order: 2

---

# Onboarding

---

parent: Firebase Components

---

# Dependencies

{: .no\_toc}

1. TOC

{:toc}

This page gives an overview of the different dependency types supported by the Components Framework.

## Background

As discussed in [Firebase Components]({{ site.baseurl }}{% link components/components.md %}), in order for a `Component` to be injected with the things it needs to function, it has to declare its dependencies. These dependencies are then made available and injected into `Components` at runtime.

Firebase Components provide different types of dependencies.

## Lazy vs Eager dependencies

When it comes to initialize a component, there are 2 ways of provide its dependencies.

### Direct Injection

With this type of injection, the component gets an instance of its dependency directly.

```
```kotlin
```

```
class MyComponent(private val dep : MyDep) {
```

```
    fun someMethod() {
```

```

    dep.use();
}
}
...

```

As you can see above the component's dependency is passed by value directly, which means that the dependency needs to be fully initialized before it's handed off to the requesting component. As a result `MyComponent` may have to pay the cost of initializing `MyDep` just to be created.

### ### Lazy/Provider Injection

With this type of injection, instead of getting an instance of the dependency directly, the dependency is passed into the `Component` with the help of a `com.google.firebase.inject.Provider`

```

```java
public interface Provider<T> { T get(); }
...

```kotlin
class MyComponent(private val dep : Provider<MyDep>) {
    fun someMethod() {
        // Since all components are singletons, each call to
        // get() will return the same instance.
        dep.get().use();
    }
}
...

```

On the surface this does not look like a big change, but it has an important side effect. In order to create an instance of `MyComponent`, we don't need to initialize `MyDep` anymore. Instead, initialization can be delayed until `MyDep` is actually used.

It is also beneficial to use a `Provider` in the context of [Play's dynamic feature delivery](https://developer.android.com/guide/playcore/feature-delivery). See [Dynamic Module Support]({{ site.baseurl }}{% link components/dynamic\_modules.md %}) for more details.

### ## Required dependencies

This type of dependency informs the `ComponentRuntime` that a given `Component` cannot function without a dependency.

When the dependency is missing during initialization, `ComponentRuntime` will throw a `MissingDependencyException`.

This type of dependency is useful for built-in components that are always present like `Context`, `FirebaseApp`, `FirebaseOptions`, [Executors]({{ site.baseurl }}{% link components/executors.md %}).

To declare a required dependency use one of the following in your `ComponentRegistrar`:

```

```java
// Required directly injected dependency
.add(Dependency.required(MyDep.class))
// Required lazily injected dependency
.add(Dependency.requiredProvider(MyOtherDep.class))
.factory( c -> new MyComponent(c.get(MyDep.class), c.getProvider(MyOtherDep.class)))
.build();
```

```

## ## Optional Dependencies

This type of dependencies is useful when your `Component` can operate normally when the dependency is not available, but can have enhanced functionality when present. e.g. `Firestore` can work without `Auth` but provides secure database access when `Auth` is present.

To declare an optional dependency use the following in your `ComponentRegistrar`:

```

```java
.add(Dependency.optionalProvider(MyDep.class))
.factory(c -> new MyComponent(c.getProvider(MyDep.class)))
.build();
```

```

The provider will return `null` if the dependency is not present in the app.

{: .warning }

When the app uses [Play's dynamic feature delivery](https://developer.android.com/guide/playcore/feature-delivery),

`provider.get()` will return your dependency when it becomes available. To support this use case, don't store references to the result of `provider.get()` calls.

See [Dynamic Module Support]({{ site.baseurl }}{% link components/dynamic\_modules.md %}) for details

{: .warning }

See Deferred dependencies if you your dependency has a callback based API

## ## Deferred Dependencies

Useful for optional dependencies which have a listener-style API, i.e. the dependent component registers a listener with the dependency and never calls it again (instead the dependency will call the registered listener). A good example is `Firestore`'s use of `Auth`, where `Firestore` registers a token change listener to get notified when a new token is available. The problem is that when `Firestore` initializes, `Auth` may not be present in the app, and is instead part of a dynamic module that can be loaded at runtime on demand.

To solve this problem, Components have a notion of a `Deferred` dependency. A deferred is defined as follows:



```

```java
public interface Deferred<T> {
    interface DeferredHandler<T> {
        @DeferredApi
        void handle(Provider<T> provider);
    }

    void whenAvailable(DeferredHandler<T> handler);
}
```

```

To use it a component needs to call `Dependency.deferred(SomeType.class)`:

```

```kotlin
class MyComponent(deferred: Deferred<SomeType>) {
    init {
        deferred.whenAvailable { someType ->
            someType.registerListener(myListener)
        }
    }
}
```

```

See [Dynamic Module Support]({{ site.baseurl }}{% link components/dynamic\_modules.md %}) for details

## ## Set Dependencies

The Components Framework allows registering components to be part of a set, such components are registered explicitly to be a part of a `Set<T>` as opposed to be a unique value of `T`:

```

```java
// Sdk 1
Component.intoSet(new SomeTypeImpl(), SomeType.class);
// Sdk 2
Component.intoSetBuilder(SomeType.class)
    .add(Dependency(SomeDep.class))
    .factory(c -> new SomeOtherImpl(c.get(SomeDep.class)))
    .build();
```

```

With the above setup each SDK contributes a value of `SomeType` into a `Set<SomeType>` which becomes available as a `Set` dependency.

To consume such a set the interested `Component` needs to declare a special kind of dependency in one of 2 ways:

\*

`Dependency.setOf(SomeType.class)`, a dependency of type `Set<SomeType>`.  
 \* `Dependency.setOfProvider(SomeType.class)`, a dependency of type `Provider<Set<SomeType>>`. The advantage of this is that the `Set` is not initialized until the first call to `provider.get()` at which point all elements of the set will get initialized.

```
{: .warning }
```

Similar to optional `Provider` dependencies, where an optional dependency can become available at runtime due to [Play's dynamic feature delivery](https://developer.android.com/guide/playcore/feature-delivery), `Set` dependencies can change at runtime by new elements getting added to the set. So make sure to hold on to the original `Set` to be able to observe new values in it as they are added.

Example:

```
```kotlin
class MyClass(private val set1: Set<SomeType>, private val set2: Provider<Set<SomeOtherType>>)
```
```

```
```java
Component.builder(MyClass.class)
    .add(Dependency.setOf(SomeType.class))
    .add(Dependency.setOfProvider(SomeOtherType.class))
    .factory(c -> MyClass(c.setOf(SomeType.class), c.setOfProvider(SomeOtherType.class)))
    .build();
```
```

## 1.32 openssl 1.1.1w

### 1.32.1 Available under license :

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## 1.33 crashlytics 31.4.0

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# contribution to the Google C++ Mocking Framework project. People  
# who commit code to the project are encouraged to add their names  
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# 1.35 curl 8.5.0

## 1.35.1 Available under license :

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## 1.36 bcpkix-fips 1.77

### 1.36.1 Available under license :

No license file was found, but licenses were detected in source scan.

Known suffixes is a list of public domain suffixes that can't be used as wild cards for

Found in path(s):

\* /bcpkix-jdk18on-177-tar-gz/bcpkix-jdk18on-177/javadoc/org/bouncycastle/est/jcajce/JsseDefaultHostnameAuthorizer.html

No license file was found, but licenses were detected in source scan.

```
<html>
<body bgcolor=#ffffff>
```

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```
<p>
```

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```
<p>
```

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<p>
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```
</body>
</html>
```

Found in path(s):

\* /bcpkix-jdk18on-177-tar-gz/bcpkix-jdk18on-177/LICENSE.html

No license file was found, but licenses were detected in source scan.

```

/**
 * Base constructor.
 * <p>
 * The authorizer attempts to perform matching (including the use of the wildcard) in accordance with RFC 6125.
 * </p>
 * <p>
 * Known suffixes is a list of public domain suffixes that can't be used as wild cards for
 * example *.com, or c*c.com, as a dns wildcard could match every/most .com domains if a registrar were issue it.
 * If *.com is in the known suffixes list will not be allowed to match.
 * </p>
 *
 * @param knownSuffixes a set of suffixes that cannot be wild-carded, e.g. { ".com", ".net", ".org" }
 */

```

Found in path(s):

```

* /bcpkix-jdk18on-177-tar-gz/bcpkix-jdk18on-177/src-
zip/org/bouncycastle/est/jcajce/JsseDefaultHostnameAuthorizer.java
No license file was found, but licenses were detected in source scan.

```

```

<html>
<head>
<title>Bouncy Castle Crypto Package</title>
</head>

```

```

<body bgcolor="#ffffff" text="#000000">

```

```

<center>
<h1>Bouncy Castle Crypto Package</h1>
<font size=1>
<pre>
</pre>
</font>
</center>

```

```

<h2>1.0 Introduction</h2>

```

The Bouncy Castle Crypto package is a Java implementation of cryptographic algorithms. The package is organised so that it contains a light-weight API suitable for use in any environment (including the newly released J2ME) with the additional infrastructure to conform the algorithms to the JCE framework.

```

<p>

```

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The OpenPGP library also includes a modified BZIP2 library which is licensed under the <a href="https://www.apache.org/licenses/">Apache Software License, Version 2.0</a>.

```

<p>

```

If you have the full package you will

have six jar files, bcpov\*.jar which contains the BC provider, jce-\*.jar which contains the JCE provider, clean room API, and bcpmail\*.jar which contains the mail API.

<p>

Note: if you are using JDK 1.0, you will just find a class hierarchy in the classes directory.

<p>

To view examples, look at the test programs in the packages:

<ul>

<li><b>org.bouncycastle.crypto.test</b>

<li><b>org.bouncycastle.jce.provider.test</b>

</ul>

<p>

To verify the packages, run the following Java programs with the appropriate classpath:

<ul>

<li><b>java org.bouncycastle.crypto.test.RegressionTest</b>

<li><b>java org.bouncycastle.jce.provider.test.RegressionTest</b>

</ul>

## <h2>2.0 Patents</h2>

<p>

Some of the algorithms in the Bouncy Castle APIs are patented in some places. It is upon the user of the library to be aware of what the legal situation is in their own situation, however we have been asked to specifically mention the patents below, in the following terms, at the request of the patent holder.

<p>

The

BC distribution contains implementations of EC MQV as described in RFC 5753, "Use of ECC Algorithms in CMS". In line with the conditions in:

<pre>

<a href="https://www.ietf.org/ietf-ftp/IPR/certicom-ipr-rfc-5753.pdf">https://www.ietf.org/ietf-ftp/IPR/certicom-ipr-rfc-5753.pdf</a>

</pre>

We state, where EC MQV has not otherwise been disabled or removed:</br />

"The use of this product or service is subject to the reasonable, non-discriminatory terms in the Intellectual Property Rights (IPR) Disclosures of Certicom Corp. at the IETF for Use of Elliptic Curve Cryptography (ECC) Algorithms in Cryptographic Message Syntax (CMS) implemented in the product or service."

</p>

## <h2>3.0 System Properties</h2>

The Bouncy Castle provider can make use of the following two system properties:

<ul>

<li><b>org.bouncycastle.ec.disable\_mqv</b> - setting this property to true will disable support for EC MQV in the



provider.</li>  
<li><b>org.bouncycastle.pkcs1.not\_strict</b> - some other providers  
of cryptography services fail to produce PKCS1 encoded block that are the correct length. Setting this property to true will relax the conformance check on the block length.</li>

</ul>

## <h2>4.0 Specifications</h2>

<ul>

<li> clean room implementation of the JCE API </li>

<li> light-weight cryptographic API consisting of support for

<ul>

<li>BlockCipher</li>

<li>BufferedBlockCipher</li>

<li>AsymmetricBlockCipher</li>

<li>BufferedAsymmetricBlockCipher</li>

<li>StreamCipher</li>

<li>BufferedStreamCipher</li>

<li>KeyAgreement</li>

<li>IESCipher</li>

<li>Digest</li>

<li>Mac</li>

<li>PBE</li>

<li>Signers</li>

</ul></li>

<li> JCE compatible framework for a Bouncy Castle provider "BC".</li>

<li> JCE compatible framework for a Bouncy Castle post-quantum provider "BCPQC".</li>

</ul>

## <h2>5.0 Light-weight API</h2>

<p>

This API has been specifically developed for those circumstances where the rich API and integration requirements of the JCE are not required.

<p>

However as a result, the light-weight API requires more effort and understanding on the part of a developer to initialise and utilise the algorithms.

### <h3>5.1 Example</h3>

<p>To utilise the light-weight API in a program, the fundamentals are as follows;

<pre>

<code>

/\*

```

* This will use a supplied key, and encrypt the data
* This is the equivalent of DES/CBC/PKCS5Padding
*/
BlockCipher engine = new DESEngine();
BufferedBlockCipher cipher = new PaddedBlockCipher(new CBCCipher(engine));

byte[] key = keyString.getBytes();
byte[] input = inputString.getBytes();

cipher.init(true, new KeyParameter(key));

byte[] cipherText = new byte[cipher.getOutputSize(input.length)];

int outputLen = cipher.processBytes(input, 0, input.length, cipherText, 0);
try
{
    cipher.doFinal(cipherText, outputLen);
}
catch (CryptoException ce)
{
    System.err.println(ce);
    System.exit(1);
}
</code>
</pre>

```

### <h3>5.2 Algorithms</h3>

<p>The light-weight API has built in support for the following:

#### <h4>Symmetric (Block)</h4>

<p>The base interface is <b>BlockCipher</b> and has the following implementations which match the modes the block cipher can be operated in.

| Name                       |  |  | Constructor        |  |  | Notes                                     |  |  |
|----------------------------|--|--|--------------------|--|--|-------------------------------------------|--|--|
| <b>BufferedBlockCipher</b> |  |  | <b>BlockCipher</b> |  |  | &nbsp;                                    |  |  |
| <b>CBCBlockCipher</b>      |  |  | <b>BlockCipher</b> |  |  | &nbsp;                                    |  |  |
| <b>CFBBlockCipher</b>      |  |  | <b>BlockCipher</b> |  |  | block size (in bits)                      |  |  |
| <b>GCFBBlockCipher</b>     |  |  | <b>BlockCipher</b> |  |  | GOST CFB mode with CryptoPro key meshing. |  |  |
| <b>EAXBlockCipher</b>      |  |  | <b>BlockCipher</b> |  |  | &nbsp;                                    |  |  |
| <b>OCBBlockCipher</b>      |  |  | <b>BlockCipher</b> |  |  | &nbsp;                                    |  |  |
| <b>OFBBlockCipher</b>      |  |  | <b>BlockCipher</b> |  |  | block size (in bits)                      |  |  |

|                              |                                   |                        |
|------------------------------|-----------------------------------|------------------------|
| <b>SICBlockCipher</b>        | BlockCipher, block size (in bits) | Also known as CTR mode |
| <b>KCTRBlockCipher</b>       | BlockCipher, block size (in bits) | DSTU7624 CTR mode      |
| <b>OpenPGPCFBBlockCipher</b> | BlockCipher                       | &nbsp;                 |
| <b>GOFBBlockCipher</b>       | BlockCipher                       | GOST OFB mode          |

The base interface for AEAD (Authenticated Encryption Associated Data) modes is **AEADBlockCipher** and has the following implementations.

| Name                     | Constructor | Notes                                               |
|--------------------------|-------------|-----------------------------------------------------|
| <b>CCMBlockCipher</b>    | BlockCipher | Packet mode - requires all data up front.           |
| <b>EAXBlockCipher</b>    | BlockCipher | &nbsp;                                              |
| <b>CCMBlockCipher</b>    | BlockCipher | Packet mode - requires all data up front.           |
| <b>GCMBlockCipher</b>    | BlockCipher | Packet mode - NIST SP 800-38D.                      |
| <b>GCMSIVBlockCipher</b> | BlockCipher | Packet mode - RFC 8452.                             |
| <b>KCCMBlockCipher</b>   | BlockCipher | DSTU 7624 Packet mode - requires all data up front. |
| <b>OCBBlockCipher</b>    | BlockCipher | &nbsp;                                              |
| <b>ChaCha20Poly1305</b>  | AEADCipher  | &nbsp;                                              |

**BufferedBlockCipher** has a further sub-classes

| Name                             | Constructor | Notes                                                                  |
|----------------------------------|-------------|------------------------------------------------------------------------|
| <b>PaddedBufferedBlockCipher</b> | BlockCipher | a buffered block cipher that can use padding - default PKCS5/7 padding |
| <b>CTSBBlockCipher</b>           | BlockCipher | Cipher Text Stealing                                                   |
| <b>NISTCTSBBlockCipher</b>       | BlockCipher | Cipher Text Stealing - NIST mode set.                                  |

The following paddings can be used with the **PaddedBufferedBlockCipher**.

| Name                     | Description         |
|--------------------------|---------------------|
| <b>PKCS7Padding</b>      | PKCS7/PKCS5 padding |
| <b>ISO10126d2Padding</b> | ISO 10126-2 padding |

|                  |                                          |
|------------------|------------------------------------------|
| X932Padding      | X9.23 padding                            |
| ISO7816d4Padding | ISO 7816-4 padding (ISO 9797-1 scheme 2) |
| ZeroBytePadding  | Pad with Zeros (not recommended)         |

The following cipher engines are implemented that can be used with the above modes.



| Name                        | Key Sizes (in bits) | Block Size                                  | Notes                                     |
|-----------------------------|---------------------|---------------------------------------------|-------------------------------------------|
| <b>AES</b> Engine           | 0 .. 256            | 128 bit                                     | &nbsp;                                    |
| <b>AES</b> WrapEngine       | 0 .. 256            | 128 bit                                     | Implements FIPS AES key wrapping          |
| <b>Ascon</b> Engine         | 128                 | 128 bit                                     | AEAD Cipher                               |
| <b>Blowfish</b> Engine      | 0 .. 448            | 64 bit                                      | &nbsp;                                    |
| <b>Camellia</b> Engine      | 128, 192, 256       | 128 bit                                     | &nbsp;                                    |
| <b>Camellia</b> WrapEngine  | 128, 192, 256       | 128 bit                                     | &nbsp;                                    |
| <b>CAST5</b> Engine         | 0 .. 128            | 64 bit                                      | &nbsp;                                    |
| <b>CAST6</b> Engine         | 0 .. 256            | 128 bit                                     | &nbsp;                                    |
| <b>DES</b> Engine           | 64                  | 64 bit                                      | &nbsp;                                    |
| <b>DESede</b> Engine        | 128, 192            | 64 bit                                      | &nbsp;                                    |
| <b>DESede</b> WrapEngine    | 128, 192            | 64 bit                                      | Implements Draft IETF DESede key wrapping |
| <b>DSTU7624</b> Engine      | 128, 256, 512       | 128/256/512 bit                             | DSTU7624 Block Cipher                     |
| <b>DSTU7624</b> WrapEngine  | 128, 256, 512       | 128/256/512 bit                             | DSTU7624 key wrapper                      |
| <b>Elephant</b> Engine      | 128                 | 128 bit                                     | AEAD Cipher                               |
| <b>GOST28147</b> Engine     | 256                 | 64 bit                                      | Has a range of S-boxes                    |
| <b>GOST3412_2015</b> Engine | 256                 | 128 bit                                     | &nbsp;                                    |
| <b>IDEA</b> Engine          | 128                 | 64 bit                                      | &nbsp;                                    |
| <b>ISAP</b> Engine          | 128                 | 128 bit                                     | AEAD Cipher                               |
| <b>LEA</b> Engine           | 128                 | 128/192/256 bit                             | &nbsp;                                    |
| <b>Noekeon</b> Engine       | 128                 | 128 bit                                     | &nbsp;                                    |
| <b>PhotonBeetle</b> Engine  | 128                 | 128 bit                                     | AEAD Cipher                               |
| <b>RC2</b> Engine           | 0 .. 1024           | 64 bit                                      | &nbsp;                                    |
| <b>RC532</b> Engine         | 0 .. 128            | 64 bit                                      | Uses a 32 bit word                        |
| <b>RC564</b> Engine         | 0 .. 128            | 128 bit                                     | Uses a 64 bit word                        |
| <b>RC6</b> Engine           | 0 .. 256            | 128 bit                                     | &nbsp;                                    |
| <b>Rijndael</b> Engine      | 0 .. 256            | 128 bit, 160 bit, 192 bit, 224 bit, 256 bit | &nbsp;                                    |
| <b>SEED</b> Engine          | 128                 | 128 bit                                     | &nbsp;                                    |
| <b>SEED</b> WrapEngine      | 128                 | 128 bit                                     | &nbsp;                                    |
| <b>Shacal2</b> Engine       | 512                 | 256 bit                                     | &nbsp;                                    |
| <b>Serpent</b> Engine       | 128, 192, 256       | 128 bit                                     | &nbsp;                                    |
| <b>Skipjack</b> Engine      | 0 .. 128            | 64 bit                                      | &nbsp;                                    |

|                        |               |                          |                        |
|------------------------|---------------|--------------------------|------------------------|
| <b>SM4Engine</b>       | 128           | 128 bit                  | &nbsp;                 |
| <b>SparkleEngine</b>   | 128           | 128 bit                  | AEAD Cipher            |
| <b>TEAEngine</b>       | 128           | 64 bit                   | &nbsp;                 |
| <b>ThreefishEngine</b> | 256/512/1024  | 256 bit/512 bit/1024 bit | Tweakable block cipher |
| <b>TwofishEngine</b>   | 128, 192, 256 | 128 bit                  | &nbsp;                 |
| <b>XoodyakEngine</b>   | 128           | 128 bit                  | AEAD Cipher            |
| <b>XTEAEngine</b>      | 128           | 64 bit                   | &nbsp;                 |

The following additional key wrapping algorithms are also available: RFC3211WrapEngine, RFC3394WrapEngine, and RFC5649WrapEngine.

#### Symmetric (Stream)

The base interface is **StreamCipher** and has the following implementations which match the modes the stream cipher can be operated in.

| Name                     | Constructor        | Notes  |
|--------------------------|--------------------|--------|
| <b>BlockStreamCipher</b> | <b>BlockCipher</b> | &nbsp; |

The following cipher engines are implemented that can be used with the above modes.

| Name                  | Key Sizes (in bits) | Notes      |
|-----------------------|---------------------|------------|
| <b>RC4Engine</b>      | 40 .. 2048          | &nbsp;     |
| <b>HC128Engine</b>    | 128                 | &nbsp;     |
| <b>HC256Engine</b>    | 256                 | &nbsp;     |
| <b>ChaChaEngine</b>   | 128/256             | 64 bit IV  |
| <b>Salsa20Engine</b>  | 128/256             | 64 bit IV  |
| <b>XSalsa20Engine</b> | 256                 | 192 bit IV |
| <b>ISAACEngine</b>    | 32 .. 8192          | &nbsp;     |
| <b>VMPCEngine</b>     | 8 .. 6144           | &nbsp;     |
| <b>Grainv1Engine</b>  | 80                  | 64 bit IV  |
| <b>Grain128Engine</b> | 128                 | 96 bit IV  |
| <b>Zuc128Engine</b>   | 128                 | 128 bit IV |
| <b>Zuc256Engine</b>   | 256                 | 200 bit IV |

#### Block Asymmetric

<p>

The base interface is <b>AsymmetricBlockCipher</b> and has the following implementations which match the modes the cipher can be operated in.

</p>

<p>

<table cellpadding=5 cellspacing=0 border=1 width=80%>

<tr><th>Name</th><th>Constructor</th><th>Notes</th></tr>

<tr><td><b>BufferedAsymmetricBlockCipher</b></td><td>AsymmetricBlockCipher</td><td>&nbsp;</td></tr>

<tr><td><b>OAEPEncoding</b></td><td>AsymmetricBlockCipher</td><td>&nbsp;</td></tr>

<tr><td><b>PKCS1Encoding</b></td><td>AsymmetricBlockCipher</td><td>&nbsp;</td></tr>

<tr><td><b>ISO9796d1Encoding</b></td><td>AsymmetricBlockCipher</td><td>ISO9796-1</td></tr>

</table>

<p>The

following cipher engines are implemented that can be used with the above modes.

<p>

<table cellpadding=5 cellspacing=0 border=1 width=80%>

<tr><th>Name</th><th>KeySizes (in bits)</th><th>Notes</th></tr>

<tr><td><b>RSAEngine</b></td><td>any multiple of 8 large enough for the encoding.</td><td>&nbsp;</td></tr>

<tr><td><b>ElGamalEngine</b></td><td>any multiple of 8 large enough for the encoding.</td><td>&nbsp;</td></tr>

<tr><td><b>NTRUEngine</b></td><td>any multiple of 8 large enough for the encoding.</td><td>&nbsp;</td></tr>

</table>

<p>The following asymmetric ciphers are also supported and allow variable block sizes:

<ul>

<li>IESEngine</li>

<li>SM2Engine</li>

</ul>

</p>

#### <h4>Digest</h4>

<p>

The

base interface is <b>Digest</b> and has the following implementations

<p>

<table cellpadding=5 cellspacing=0 border=1 width=80%>

<tr><th>Name</th><th>Output (in bits)</th><th>Notes</th></tr>

<tr><td><b>AsconDigest</b></td><td>256</td><td></td></tr>

<tr><td><b>AsconXof</b></td><td>XOF</td><td></td></tr>

<tr><td><b>Blake2bDigest</b></td><td>224, 256, 384, 512</td><td></td></tr>

<tr><td><b>Blake3Digest</b></td><td>224, 256, 384, 512</td><td></td></tr>

<tr><td><b>CSHAKEDigest</b></td><td>XOF</td><td>SP 800-185, based on SHAKE128/SHAKE256</td></tr>

|                                |                         |                                                                                           |
|--------------------------------|-------------------------|-------------------------------------------------------------------------------------------|
| <b>DSTU7564Digest</b>          | 256, 384, 512           |                                                                                           |
| <b>ISAPDigest</b>              | 256                     |                                                                                           |
| <b>Kangaroo</b>                | XOF                     | Built on Keccak-p                                                                         |
| <b>KeccakDigest</b>            | 224, 256, 288, 384, 512 |                                                                                           |
| <b>MD2Digest</b>               | 128                     | &nbsp;                                                                                    |
| <b>MD4Digest</b>               | 128                     | &nbsp;                                                                                    |
| <b>MD5Digest</b>               | 128                     | &nbsp;                                                                                    |
| <b>ParallelHash</b>            | XOF                     | XOF based on cSHAKE (SP 800-185).                                                         |
| <b>PhotonBeetleDigest</b>      | 256                     |                                                                                           |
| <b>RipeMD128Digest</b>         | 128                     | basic RipeMD                                                                              |
| <b>RipeMD160Digest</b>         | 160                     | enhanced version of RipeMD                                                                |
| <b>RipeMD256Digest</b>         | 256                     | expanded version of RipeMD128                                                             |
| <b>RipeMD320Digest</b>         | 320                     | expanded version of RipeMD160                                                             |
| <b>SHA1Digest</b>              | 160                     | &nbsp;                                                                                    |
| <b>SHA224Digest</b>            | 224                     | FIPS 180-2                                                                                |
| <b>SHA256Digest</b>            | 256                     | FIPS 180-2                                                                                |
| <b>SHA384Digest</b>            | 384                     | FIPS 180-2                                                                                |
| <b>SHA512Digest</b>            | 512                     | FIPS 180-2                                                                                |
| <b>SHA3Digest</b>              | 224, 256, 384, 512      |                                                                                           |
| <b>SHAKEDigest</b>             | 128, 256                | cSHAKE primitive also supported.                                                          |
| <b>SkeinDigest</b>             | any byte length         | 256 bit, 512 bit and 1024 state sizes. Additional parameterisation using SkeinParameters. |
| <b>SM3Digest</b>               | 256                     | The SM3 Digest.                                                                           |
| <b>SparkleDigest</b>           | 256                     |                                                                                           |
| <b>TigerDigest</b>             | 192                     | The Tiger Digest.                                                                         |
| <b>TupleHash</b>               | XOF                     | XOF based on cSHAKE (SP 800-185).                                                         |
| <b>GOST3411Digest</b>          | 256                     | The GOST-3411 Digest.                                                                     |
| <b>GOST3411_2012_256Digest</b> | 256                     | The GOST-3411-2012-256 Digest.                                                            |
| <b>GOST3411_2012_512Digest</b> | 512                     | The GOST-3411-2012-512 Digest.                                                            |
| <b>WhirlpoolDigest</b>         | 512                     | The Whirlpool Digest.                                                                     |
| <b>Haraka256Digest</b>         | 256                     | Haraka V2 - 256 bit input version.                                                        |
| <b>Haraka512Digest</b>         | 256                     | Haraka V2 - 512 bit input version.                                                        |
| <b>XoodyakDigest</b>           | 256                     |                                                                                           |

#### MAC

The base interface is **Mac** and has the following implementations

| Name | Output (in bits) | Notes |
|------|------------------|-------|
|------|------------------|-------|

|                          |                                                  |                                                                                                   |
|--------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>CBCBlockCipherMac</b> | blocksize/2 unless specified                     | &nbsp;                                                                                            |
| <b>CFBBlockCipherMac</b> | blocksize/2, in CFB 8 mode, unless specified     | &nbsp;                                                                                            |
| <b>CMac</b>              | 24 to cipher block size bits                     | Usable with block ciphers, NIST SP 800-38B.                                                       |
| <b>GMac</b>              | 32 to 128 bits                                   | Usable with GCM mode ciphers, defined for AES, NIST SP 800-38D.                                   |
| <b>GOST28147Mac</b>      | 32 bits                                          | &nbsp;                                                                                            |
| <b>ISO9797Alg3Mac</b>    | multiple of 8 bits up to underlying cipher size. | &nbsp;                                                                                            |
| <b>HTMac</b>             | digest length                                    | &nbsp;                                                                                            |
| <b>DSTU7564</b>          | 256, 384, 512 bits                               | &nbsp;                                                                                            |
| <b>DSTU7624</b>          | 128, 256, 512 bits                               | &nbsp;                                                                                            |
| <b>Poly1305</b>          | 128 bits                                         | Usable with 128 bit block ciphers. Use Poly1305KeyGenerator to generate keys.                     |
| <b>SkeinMac</b>          | any byte length                                  | 256 bit, 512 bit and 1024 state size variants. Additional parameterisation using SkeinParameters. |
| <b>SipHash</b>           | 64 bits                                          | &nbsp;                                                                                            |
| <b>SipHash128</b>        | 128 bits                                         | &nbsp;                                                                                            |
| <b>VMPCMac</b>           | 160 bits                                         | &nbsp;                                                                                            |
| <b>Zuc128Mac</b>         | 32 bits                                          | &nbsp;                                                                                            |
| <b>Zuc256Mac</b>         | 32, 64, 128 bits                                 | &nbsp;                                                                                            |

#### PBE and Password Hashing

The base class is **PBEPParametersGenerator** and has the following sub-classes

| cellpadding=5 cellspacing=0 border=1 width=80% |             |                                  |
|------------------------------------------------|-------------|----------------------------------|
| Name                                           | Constructor | Notes                            |
| <b>PKCS5S1ParametersGenerator</b>              |             | Digest &nbsp;                    |
| <b>PKCS5S2ParametersGenerator</b>              |             | &nbsp; Uses SHA1/Hmac as defined |
| <b>PKCS12ParametersGenerator</b>               |             | Digest &nbsp;                    |
| <b>OpenSSLPBEPParametersGenerator</b>          |             | &nbsp; Uses MD5 as defined       |

The following password hashing schemes are supported:

| cellpadding=5 cellspacing=0 border=1 width=80% |             |        |
|------------------------------------------------|-------------|--------|
| Name                                           | Constructor | Notes  |
| <b>Argon2</b>                                  |             | &nbsp; |
| <b>BCrypt</b>                                  |             | &nbsp; |
| <b>OpenBSDBcrypt</b>                           |             | &nbsp; |
| <b>SCrypt</b>                                  |             | &nbsp; |



</table>

#### <h4>IESCipher</h4>

<p>

The IES cipher is based on the one described in IEEE P1363a (draft 10), for use with either traditional Diffie-Hellman or Elliptic Curve Diffie-Hellman.

</p>

<b>Note:</b> At the moment this is still a draft, don't use it for anything that may be subject to long term storage, the key values produced may well change as the draft is finalised.

</p>

#### <h4>Commitments</h4>

<p>

The base class is <b>Committer</b> and has the following sub-classes

</p>

<table cellpadding=5 cellspacing=0 border=1 width=80%>

<tr><th>Name</th><th>Notes</th></tr>

<tr><td><b>HashCommitter</b></td><td>Hash commitment algorithm described in Usenix RPC MixNet Paper (2002)</td></tr>

</table>

#### <h4>Key Agreement</h4>

<p>

Two versions of Diffie-Hellman key agreement are supported, the basic version, and one for use with long term public keys. Two versions of key agreement using Elliptic Curve cryptography are also supported, standard Diffie-Hellman key agreement and standard key agreement with co-factors.

</p>

<p>

The agreement APIs are in the <b>org.bouncycastle.crypto.agreement</b> package.

Classes for generating Diffie-Hellman parameters can be found in the

<b>org.bouncycastle.crypto.params</b> and <b>org.bouncycastle.crypto.generators</b> packages.

</p>

#### <h4>Key Encapsulation Mechanisms</h4>

<p>

The first non-post-quantum set use the <b>EncapsulatedSecretGenerator</b> and <b>EncapsulatedSecretGenerator</b> interfaces.

</p>

<table cellpadding=5 cellspacing=0 border=1 width=80%>

<thead>

<tr><th>Name</th><th>Notes</th></tr>

</thead>

```

<tbody>
<tr><td><b>RSA</b></td><td>RSA-KEM from ISO 18033-2, implemented in <b>RSAKEMExtractor</b> and
<b>RSAKEMGenerator</b></td></tr>
<tr><td><b>ECIES</b></td><td>ECIES-KEM from ISO 18033-2, implemented in <b>ECIESKEMExtractor</b>
and <b>ECIESKEMGenerator</b></td></tr>
</tbody>
</table>
<p>
The second, post-quantum set use <b>EncapsulatedSecretGenerator</b> and <b>EncapsulatedSecretGenerator</b>.
</p>

```

```

<table cellpadding=5 cellspacing=0 border=1 width=80%>
<tbody>
<tr><th>Name</th><th>Security Strength (in bits)</th><th>Implementations</th><th>Notes</th></tr>
<tr><td><b>BIKE</b></td><td>128-256.</td><td><b>BIKEKEMGenerator</b>,<br>
<b>BIKEKEMExtractor</b></td><td>Round&nbsp;4</td></tr>
<tr><td><b>Classic McEliece</b></td><td>128-256.</td><td><b>CMCEKEMGenerator</b>,<br>
<b>CMCEKEMExtractor</b></td><td>Round&nbsp;4</td></tr>
<tr><td><b>FrodoKEM</b></td><td>128-256.</td><td><b>FrodoKEMGenerator</b>,<br>
<b>FrodoKEMExtractor</b></td><td></td></tr>
<tr><td><b>HQC</b></td><td>128-256.</td><td><b>HQCKEMGenerator</b>,<br>
<b>HQCKEMExtractor</b></td><td>Round&nbsp;4</td></tr>
<tr><td><b>Kyber</b></td><td>128-256.</td><td><b>KyberKEMGenerator</b>,<br>
<b>KyberKEMExtractor</b></td><td>Finalist</td></tr>
<tr><td><b>NTRU</b></td><td>128-256.</td><td><b>NTRUKEMGenerator</b>,<br>
<b>NTRUKEMExtractor</b></td><td></td></tr>
<tr><td><b>NTRU Prime</b></td><td>128-256.</td><td><b>NTRULPrimeKEMGenerator</b>,<br>
<b>NTRULPrimeKEMExtractor</b></td><td><b>SNTRUPrimeKEMGenerator</b>,<br>
<b>SNTRUPrimeKEMExtractor</b></td><td></td></tr>
<tr><td><b>SABER</b></td><td>128-256.</td><td><b>SABERKEMGenerator</b>,<br>
<b>SABERKEMExtractor</b></td><td></td></tr>
</tbody>
</table>

```

```

</p>

<h4>Signers</h4>
<p>
DSA, ECDSA, ISO-9796-2, GOST-3410-94, GOST-3410-2001, GOST-3410-2012, DSTU-4145-2002, and RSA-
PSS are supported by the <b>org.bouncycastle.crypto.signers</b>
package. Note: as these are light weight classes, if you need to use SHA1 or GOST-3411
(as defined in the relevant standards) you'll also need to make use of the appropriate
digest class in conjunction with these.
Classes for generating DSA and ECDSA parameters can be found in the
<b>org.bouncycastle.crypto.params</b> and <b>org.bouncycastle.crypto.generators</b> packages.
</p>

```

```

<h3>5.4 Elliptic Curve Transforms.</h3>

```

<p>

The org.bouncycastle.crypto.ec package contains implementations for a variety of EC cryptographic transforms such as EC ElGamal.

</p>

### <h3>5.5 TLS/DTLS</h3>

<p>

The org.bouncycastle.crypto.tls package contains implementations for TLS 1.1, 1.2 and DTLS 1.0, 1.2.

</p>

### <h3>5.6

Deterministic Random Bit Generators (DRBG) and SecureRandom wrappers</h3>

<p>

The org.bouncycastle.crypto.prng package contains implementations for a variety of bit generators including those from SP 800-90A and X9.31, as well as builders for SecureRandom objects based around them.

</p>

### <h3>5.7 ASN.1 package</h3>

<p>The light-weight API has direct interfaces into a package capable of reading and writing DER-encoded ASN.1 objects and for the generation of X.509 V3 certificate objects and PKCS12 files. BER InputStream and OutputStream classes are provided as well.

## <h2>6.0 Bouncy Castle Provider</h2>

<p>The Bouncy Castle provider is a JCE compliant provider that is a wrapper built on top of the light-weight API. The main provider is referred to with the name "BC", the post quantum provider is indicated by "BCPQC".</p>

<p>

The advantage for writing application code that uses the provider interface to cryptographic algorithms is that the actual provider used can be selected at run time. This is extremely valuable for applications that may wish to make use of a provider that has underlying hardware for cryptographic computation, or where an application may have been developed in an environment with cryptographic export controls.

</p>

### <h3>6.1 Example</h3>

<p>To utilise the JCE provider in a program, the fundamentals are as follows;

```

<pre>
<code>
/*
 * This will generate a random key, and encrypt the data
 */
Key key;
KeyGenerator keyGen;
Cipher encrypt;

Security.addProvider(new BouncyCastleProvider());

try
{
    // "BC" is the name of the BouncyCastle provider
    keyGen = KeyGenerator.getInstance("DES", "BC");
    keyGen.init(new SecureRandom());

    key = keyGen.generateKey();

    encrypt = Cipher.getInstance("DES/CBC/PKCS5Padding", "BC");
}
catch (Exception e)
{
    System.err.println(e);
    System.exit(1);
}

encrypt.init(Cipher.ENCRYPT_MODE, key);

bOut = new ByteArrayOutputStream();
cOut = new CipherOutputStream(bOut, encrypt);

cOut.write("plaintext".getBytes());
cOut.close();

//
bOut now contains the cipher text
</code>
</pre>
<p>

```

The provider can also be configured as part of your environment via static registration by adding an entry to the java.security properties file (found in \$JAVA\_HOME/jre/lib/security/java.security, where \$JAVA\_HOME is the location of your JDK/JRE distribution). You'll find detailed instructions in the file but basically it comes down to adding a line:

```

<pre>
<code>
    security.provider.&lt;n>=org.bouncycastle.jce.provider.BouncyCastleProvider
</code>

```

</pre>

<p>Where &lt;n> is the preference you want the provider at (1 being the most preferred).

<p>Where you put the jar is up to mostly up to you, although with jdk1.3 and

jdk1.4 the best (and in some cases only) place to have it is in \$JAVA\_HOME/jre/lib/ext. Note: under Windows there will normally be a JRE and a JDK install of Java if you think you have installed it correctly and it still doesn't work chances are you have added the provider

to the installation not being used.

<p>

<b>Note</b>: with JDK 1.4 and later you will need to have installed the unrestricted policy files to take full advantage of the provider. If you do not install the policy files you are likely to get something like the following:

<b>

<pre>

```
java.lang.SecurityException: Unsupported keysize or algorithm parameters
    at javax.crypto.Cipher.init(DashoA6275)
```

</pre>

</b>

The policy files can be found at the same place you downloaded the JDK.

<p>

### <h3>6.2 Algorithms</h3>

#### <h4>Symmetric (Block)</h4>

<p>Modes:

<ul>

<li>ECB</li>

<li>CBC</li>

<li>OFB(n)</li>

<li>CFB(n)</li>

<li>SIC (also known as CTR)</li>

<li>OpenPGPCFB</li>

<li>CTS (equivalent to CBC/WithCTS)</li>

<li>FF1</li>

<li>FF3-1</li>

<li>GOFB</li>

<li>GCFB</li>

<li>CCM (AEAD)</li>

<li>EAX (AEAD)</li>

<li>GCM (AEAD)</li>

<li>GCM-SIV (AEAD)</li>

<li>OCB (AEAD)</li>

</ul>

<p>

Where <i>(n)</i> is a multiple of 8 that gives the blocksize in bits,

eg, OFB8. Note that OFB and CFB

mode can be used with plain text that

is not an exact multiple of the block size if NoPadding has been specified.

<p>

All <i>AEAD</i> (Authenticated Encryption Associated Data) modes support Additional Authentication Data (AAD) using the <code>Cipher.updateAAD()</code> methods added in Java SE 7. <br>

On Java 7 and later, AEAD modes will throw <code>javax.crypto.AEADBadTagException</code> on an authentication failure.

On earlier version of Java, <code>javax.crypto.BadPaddingException</code> is thrown.

<p>

Padding Schemes:

<ul>

<li>No padding

<li>PKCS5/7

<li>ISO10126/ISO10126-2

<li>ISO7816-4/ISO9797-1

<li>X9.23/X923

<li>TBC

<li>ZeroByte

<li>withCTS (if used with ECB mode)

</ul>

<p>

When placed together this gives a specification for an algorithm

as;

<ul>

<li>DES/CBC/X9.23Padding

<li>DES/OFB8/NoPadding

<li>IDEA/CBC/ISO10126Padding

<li>IDEA/CBC/ISO7816-4Padding

<li>SKIPJACK/ECB/PKCS7Padding

<li>DES/ECB/WithCTS

</ul>

<p>

Note: default key sizes are in bold.

<p>

<table cellpadding=5 cellspacing=0

border=1 width=80%>

<tr><th>Name</th><th>Key Sizes (in bits) </th><th>Block Size</th><th>Notes</th></tr>

<tr><td>AES</td><td>0 .. 256 <b>(192)</b></td><td>128 bit</td><td>&nbsp;</td></tr>

<tr><td>AESWrap</td><td>0 .. 256 <b>(192)</b></td><td>128 bit</td><td>A FIPS AES key wrapper</td></tr>

<tr><td>ARIA</td><td>0 .. 256 <b>(192)</b></td><td>128 bit</td><td>&nbsp;</td></tr>

<tr><td>ARIAWrap</td><td>0 .. 256 <b>(192)</b></td><td>128 bit</td><td>An ARIA key wrapper (based on RFC 5649)</td></tr>

<tr><td>Blowfish</td><td>0 .. 448 <b>(448)</b></td><td>64 bit</td><td>&nbsp;</td></tr>

<tr><td>Camellia</td><td>128, 192, 256</td><td>128 bit</td><td>&nbsp;</td></tr>

<tr><td>CamelliaWrap</td><td>128, 192, 256</td><td>128 bit</td><td>&nbsp;</td></tr>

CAST5	0 .. 128	(128)	64 bit	
CAST6	0 .. 256	(256)	128 bit	
DES	64	64 bit		
DESede	128,			
	192	64 bit		
DESedeWrap	128, 192	128 bit		A Draft IETF DESede key wrapper
DSTU7624	128, 256, 512	128/256/512 bit		DSTU7624 Block Cipher
DSTU7624Wrap	128, 256, 512	128/256/512 bit		DSTU7624 key wrapper
GCM	128, 192, 256	(192)		AEAD Mode Cipher
				Galois/Counter Mode, as defined in NIST Special Publication SP 800-38D.
GOST28147	256	64 bit		
IDEA	128	(128)	64 bit	
Noekeon	128	(128)	128 bit	
RC2	0 .. 1024	(128)	64 bit	
RC5	0 .. 128	(128)	64 bit	Uses a 32 bit word
RC5-64	0 .. 256	(256)	128 bit	Uses a 64 bit word
RC6	0 .. 256	(128)	128 bit	
Rijndael	0 .. 256	(192)	128 bit	
SEED	128	(128)	128 bit	
SEEDWrap	128	(128)	128 bit	
Serpent	128, 192, 256	(256)	128 bit	
Skipjack	0 .. 128	(128)	64 bit	
SM4	128	(128)	128 bit	
TEA	128	(128)	64 bit	
Threefish-256	256	256 bit		
Threefish-512	512	512 bit		
Threefish-1024	1024	1024 bit		
Twofish	128, 192, 256	(256)	128 bit	
XTEA	128	(128)	64 bit	

#### Symmetric (Stream)

Note: default key sizes are in bold.



Name	Key Sizes (in bits)	Notes
------	---------------------	-------

RC4	40 .. 2048 bits	(128)
-----	-----------------	-------

HC128	(128)	
-------	-------	--

HC256	(256)	
-------	-------	--

ChaCha	128	256	64 bit IV
--------	-----	-----	-----------

Salsa20	128	256	64 bit IV
---------	-----	-----	-----------

XSalsa20	256	182 bit IV
----------	-----	------------

VMPC	128/6144	(128)	
Grainv1	80	64 bit IV	
Grain128	128	96 bit IV	
Grain128AEAD	128	96 bit IV	
Zuc128	128	128 bit IV	
Zuc256	256	200 bit IV	

#### Block Asymmetric

Encoding:

- OAEP - Optimal Asymmetric Encryption Padding
- PKCS1 - PKCS v1.5 Padding
- ISO9796-1 - ISO9796-1 edition 1 Padding

Note: except as indicated in PKCS 1v2 we recommend you use OAEP, as mandated in X9.44.

When placed together with RSA this gives a specification for an algorithm as;

- RSA/NONE/NoPadding
- RSA/NONE/PKCS1Padding
- RSA/NONE/OAEPWithMD5AndMGF1Padding
- RSA/NONE/OAEPWithSHA1AndMGF1Padding
- RSA/NONE/OAEPWithSHA224AndMGF1Padding
- RSA/NONE/OAEPWithSHA256AndMGF1Padding
- RSA/NONE/OAEPWithSHA384AndMGF1Padding
- RSA/NONE/OAEPWithSHA512AndMGF1Padding
- RSA/NONE/OAEPWithSHA3-224AndMGF1Padding
- RSA/NONE/OAEPWithSHA3-256AndMGF1Padding
- RSA/NONE/OAEPWithSHA3-384AndMGF1Padding
- RSA/NONE/OAEPWithSHA3-512AndMGF1Padding
- RSA/NONE/ISO9796-1Padding

Name	KeySizes (in bits)	Notes
RSA	any multiple of 8 bits large enough for the encryption	(2048)
ElGamal	any multiple of 8 bits large enough for the encryption	(1024)



#### Key Agreement

Diffie-Hellman key agreement is supported using the "DH", "DHU" (Diffie-Hellman Unified), "ECDH", "ECCDH" (EC Cofactor DH), "ECKAEG" (BSI EC KAEG key agreement), "ECMQV" and "ECCDHU" (EC Cofactor DH Unified) key agreement instances and their variations. Key exchange, which also uses the KeyAgreement API is supported by "NH" (the NewHope algorithm (BCPQC)). SM2 key exchange is currently supported in the lightweight API.

Support is provided for the standard SEC algorithm set for EC. Names appear in the form of [Agreement]with[KDF PRF Digest][KDF type]. For example:

"ECCDHwithSHA256KDF" which represents EC cofactor DH using the X9.63 KDF with SHA256 as the PRF

"ECMQVwithSHA1CKDF"

which represents EC MQV using the concatenation KDF with SHA1 as the PRF

Note: with basic "DH" only the basic algorithm fits in with the JCE API, if you're using long-term public keys you may want to look at the light-weight API, there are also additional JCE support classes for UserKeyingMaterial and MQVParameters in the `org.bouncycastle.jcajce.spec` package.

#### Key Encapsulation Mechanisms







Name	ParameterSpec Class	Notes
------	---------------------	-------







CMCE	CMCEParameterSpec	Class McEliece (NIST Alternate Candidate)
------	-------------------	-------------------------------------------

Frodo	FrodoParameterSpec	FrodoKEM (NIST Alternate Candidate)
-------	--------------------	-------------------------------------

SABER	SABERParameterSpec	SABER (NIST Finalist)
-------	--------------------	-----------------------







If used for key wrapping via the Cipher class, you will also need to make use of the KEMParameterSpec class to specify a symmetric wrapping algorithm.

If access to the shared secret is required, KeyGenerator implementations can also be used in conjunction with the KEMGenerateSpec and the KEMExtractSpec which return the shared secret directly.

#### ECIES

An implementation of ECIES (stream mode) as described in IEEE P 1363a. This now based more formally on

Victor Shoup's paper and should be compatible with the implementation in Crypto++ (version 6 onwards).

#### Digest



Name	Output (in bits)	Notes
------	------------------	-------

Blake2b-160	160	
-------------	-----	--

Blake2b-256	256	
-------------	-----	--

Blake2b-384	384	
-------------	-----	--

Blake2b-512	512	
-------------	-----	--

Blake2s-128	128	
-------------	-----	--

Blake2s-160	160	
-------------	-----	--

Blake2s-224	224	
-------------	-----	--

Blake2s-256	256	
-------------	-----	--

Blake3-256	256	
------------	-----	--

DSTU7564-256	256	
--------------	-----	--

DSTU7564-384	384	
--------------	-----	--

DSTU7564-512	512	
--------------	-----	--

GOST3411	256	
----------	-----	--

GOST3411-2012-256	256	
-------------------	-----	--

GOST3411-2012-512	512	
-------------------	-----	--

Haraka-256	256	
------------	-----	--

Haraka-512	256	
------------	-----	--

Keccak-224	224	
------------	-----	--

Keccak-288	288	
------------	-----	--

Keccak-256	256	
------------	-----	--

Keccak-384	384	
------------	-----	--

Keccak-512	512	
------------	-----	--

MD2	128	
-----	-----	--

MD4	128	
-----	-----	--

MD5	128	
-----	-----	--

RipeMD128	128	basic
-----------	-----	-------

RipeMD		
--------	--	--

RipeMD160	160	enhanced version of RipeMD
-----------	-----	----------------------------

RipeMD256	256	expanded version of RipeMD128
-----------	-----	-------------------------------

RipeMD320	320	expanded version of RipeMD160
-----------	-----	-------------------------------

SHA1	160	
------	-----	--

SHA-224	224	FIPS 180-2
---------	-----	------------

SHA-256	256	FIPS 180-2
---------	-----	------------

SHA-384	384	FIPS 180-2
---------	-----	------------

SHA-512	512	FIPS 180-2
---------	-----	------------

SHA3-224	224	FIPS 202
----------	-----	----------

SHA3-256	256	FIPS 202
----------	-----	----------

SHA3-384	384	FIPS 202
----------	-----	----------

SHA3-512	512	FIPS 202
----------	-----	----------

Skein-256-*	128, 160, 224, 256	e.g. Skein-256-160
-------------	--------------------	--------------------

Skein-512-*	128, 160, 224, 256, 384, 512	e.g. Skein-512-256
-------------	------------------------------	--------------------

Skein-1024-*	384,	
--------------	------	--

512, 1024	e.g. Skein-1024-1024
SM3	256
Tiger	192
Whirlpool	512

#### MAC

Name	Output (in bits)	Notes
Any MAC based on a block cipher, CBC (the default) and CFB modes.	half the cipher's block size (usually 32 bits)	
*-GMAC	32 to 128 bits	Usable with GCM mode ciphers, defined for AES, NIST SP 800-38D. e.g. AES-GMAC.
VMPC-MAC	128	
hMac-GOST3411	256	
hMac-GOST3411-2012-256	256	
hMac-GOST3411-2012-512	512	
hMac-KECCAK224	224	
hMac-KECCAK256	256	
hMac-KECCAK288	288	
hMac-KECCAK384	384	
hMac-KECCAK512	512	
hMac-MD2	128	
hMac-MD4	128	
hMac-MD5	128	
hMac-RipeMD128	128	
hMac-RipeMD160	160	
hMac-SHA1	160	
hMac-SHA224	224	
hMac-SHA256	256	
hMac-SHA384	384	
hMac-SHA512	512	
hMac-SHA3-224	224	
hMac-SHA3-256	256	
hMac-SHA3-384	384	
hMac-SHA3-512	512	
HMAC-Skein-256-*	128, 160, 224, 256	e.g. HMAC-Skein-256-160
HMAC-Skein-512-*	128, 160, 224, 256, 384, 512	e.g. HMAC-Skein-512-256
HMAC-Skein-1024-*	384, 512, 1024	e.g. HMAC-Skein-1024-1024
Siphash-2-4 (SipHash)	64	
Siphash-4-8	64	
Siphash128-2-4 (SipHash128)	128	
Skein-MAC-256-*	128, 160, 224, 256	e.g. Skein-MAC-256-160
Skein-MAC-512-*	128, 160, 224, 256, 384, 512	e.g. Skein-MAC-512-256
Skein-MAC-1024-*	384, 512, 1024	e.g. Skein-MAC-1024-1024

HMac-Tiger	192	&nbsp;
Poly1305-*	128	Defined for recent 128 bit block ciphers, e.g. Poly1305-AES, Poly1305-Serpent
ZUC-128	32	
ZUC-256-32	32	
ZUC-256-64	64	
ZUC-256-128	128	

Examples:

- DESMac
- DESMac/CFB8
- DESedeMac
- DESedeMac/CFB8
- DESedeMac64
- SKIPJACKMac
- SKIPJACKMac/CFB8
- IDEAMac
- IDEAMac/CFB8
- RC2Mac
- RC2Mac/CFB8
- RC5Mac
- RC5Mac/CFB8
- ISO9797ALG3Mac

#### Signature Algorithms

Schemes:

- DSTU4145
- Ed25519
- Ed448
- GOST3411withGOST3410 (GOST3411withGOST3410-94)
- GOST3411withECGOST3410 (GOST3411withGOST3410-2001)
- MD2withRSA
- MD5withRSA
- SHA1withRSA
- RIPEMD128withRSA
- RIPEMD160withRSA
- RIPEMD160withDSA
- RIPEMD160withECDSA
- RIPEMD256withRSA
- SHA1withDSA
- SHA224withDSA

<li>SHA256withDSA</li>  
<li>SHA384withDSA</li>  
<li>SHA512withDSA</li>  
<li>SHA3-224withDSA</li>  
<li>SHA3-256withDSA</li>  
<li>SHA3-384withDSA</li>  
<li>SHA3-512withDSA</li>  
<li>SHA1withDDSA</li>  
<li>SHA224withDDSA</li>  
<li>SHA256withDDSA</li>  
<li>SHA384withDDSA</li>  
<li>SHA512withDDSA</li>  
<li>SHA3-224withDDSA</li>  
<li>SHA3-256withDDSA</li>  
<li>SHA3-384withDDSA</li>  
<li>SHA3-512withDDSA</li>  
<li>NONEwithDSA</li>  
<li>SHA1withDetECDSA</li>  
<li>SHA224withECDDSA</li>  
<li>SHA256withECDDSA</li>  
<li>SHA384withECDDSA</li>  
<li>SHA512withECDDSA</li>  
<li>SHA1withECDSA</li>  
<li>NONEwithECDSA</li>  
<li>SHA224withECDSA</li>  
<li>SHA256withECDSA</li>  
<li>SHA384withECDSA</li>  
<li>SHA512withECDSA</li>  
<li>SHA3-224withECDSA</li>  
<li>SHA3-256withECDSA</li>  
<li>SHA3-384withECDSA</li>  
<li>SHA3-512withECDSA</li>  
<li>SHAKE128withECDSA</li>  
<li>SHAKE256withECDSA</li>  
<li>SHA1withPLAIN-ECDSA</li>  
<li>SHA224withPLAIN-ECDSA</li>  
<li>SHA256withPLAIN-ECDSA</li>  
<li>SHA384withPLAIN-ECDSA</li>  
<li>SHA512withPLAIN-ECDSA</li>  
<li>SHA3-224withPLAIN-ECDSA</li>  
<li>SHA3-256withPLAIN-ECDSA</li>  
<li>SHA3-384withPLAIN-ECDSA</li>  
<li>SHA3-512withPLAIN-ECDSA</li>  
<li>SHA1withECNR</li>  
<li>SHA224withECNR</li>  
<li>SHA256withECNR</li>  
<li>SHA384withECNR</li>  
<li>SHA512withECNR</li>

- <li>SHA224withRSA</li>
- <li>SHA256withRSA</li>
- <li>SHA384withRSA</li>
- <li>SHA512withRSA</li>
- <li>SHA512(224)withRSA</li>
- <li>SHA512(256)withRSA</li>
- <li>SHA3-224withRSA</li>
- <li>SHA3-256withRSA</li>
- <li>SHA3-384withRSA</li>
- <li>SHA3-512withRSA</li>
- <li>SHA1withRSAandMGF1</li>
- <li>SHA256withRSAandMGF1</li>
- <li>SHA384withRSAandMGF1</li>
- <li>SHA512withRSAandMGF1</li>
- <li>SHA512(224)withRSAandMGF1</li>
- <li>SHA512(256)withRSAandMGF1</li>
- <li>SHA1withRSA/ISO9796-2</li>
- <li>RIPEMD160withRSA/ISO9796-2</li>
- <li>SHA1withRSA/X9.31</li>
- <li>SHA224withRSA/X9.31</li>
- <li>SHA256withRSA/X9.31</li>
- <li>SHA384withRSA/X9.31</li>
- <li>SHA512withRSA/X9.31</li>
- <li>SHA512(224)withRSA/X9.31</li>
- <li>SHA512(256)withRSA/X9.31</li>
- <li>RIPEMD128withRSA/X9.31</li>
- <li>RIPEMD160withRSA/X9.31</li>
- <li>WHIRLPOOLwithRSA/X9.31</li>
- <li>SHA512withSPHINCS256 (BCPQC)</li>
- <li>SHA3-512withSPHINCS256 (BCPQC)</li>
- <li>SHA256withSM2</li>
- <li>SM3withSM2</li>
- <li>LMS</li>
- <li>Dilithium</li>
- <li>Falcon</li>
- <li>Picnic</li>
- <li>SPHINCS+</li>
- <li>XMSS-SHA256</li>
- <li>XMSS-SHA512</li>
- <li>XMSS-SHAKE128</li>
- <li>XMSS-SHAKE256</li>
- <li>XMSSMT-SHA256</li>
- <li>XMSSMT-SHA512</li>
- <li>XMSSMT-SHAKE128</li>
- <li>XMSSMT-SHAKE256</li>
- <li>SHA256withXMSS-SHA256</li>
- <li>SHA512withXMSS-SHA512</li>

- <li>SHAKE128withXMSS-SHAKE128</li>
- <li>SHAKE256withXMSS-SHAKE256</li>
- <li>SHA256withXMSSMT-SHA256</li>
- <li>SHA512withXMSSMT-SHA512</li>
- <li>SHAKE128withXMSSMT-SHAKE128</li>
- <li>SHAKE256withXMSSMT-SHAKE256</li>

#### <h4>Password Hashing and PBE</h4>

<p>Schemes:

- <li>BCrypt</li>
- <li>OpenBSDBcrypt</li>
- <li>SCrypt</li>
- <li>PKCS5S1, any Digest, any symmetric Cipher, ASCII </li>
- <li>PKCS5S2, any HMac, any symmetric Cipher, ASCII, UTF8</li>
- <li>PKCS12, any Digest, any symmetric Cipher, Unicode </li>

<p>

Defined in Bouncy Castle JCE Provider

cellpadding=5 cellspacing=0 border=1 width=80%>			
<tr><th>Name</th><th>Key Generation Scheme</th><th>Key Length (in bits)</th><th>Char to Byte conversion</th></tr>			
<tr><td>PBewithMD2AndDES</td><td>PKCS5 Scheme 1</td><td>64</td><td>8 bit chars</td></tr>			
<tr><td>PBewithMD2AndRC2</td><td>PKCS5 Scheme 1</td><td>128</td><td>8 bit chars</td></tr>			
<tr><td>PBewithMD5AndDES</td><td>PKCS5 Scheme 1</td><td>64</td><td>8 bit chars</td></tr>			
<tr><td>PBewithMD5AndRC2</td><td>PKCS5 Scheme 1</td><td>128</td><td>8 bit chars</td></tr>			
<tr><td>PBewithSHA1AndDES</td><td>PKCS5 Scheme 1</td><td>64</td><td>8 bit chars</td></tr>			
<tr><td>PBewithSHA1AndRC2</td><td>PKCS5 Scheme 1</td><td>128</td><td>8 bit chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA1</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA1AndUTF8</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA1And8bit</td><td>PKCS5 Scheme 2</td><td>variable</td><td>8 bit chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA224</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA256</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA384</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA512</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA3-224</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8 chars</td></tr>			
<tr><td>PBKDF2WithHmacSHA3-256</td><td>PKCS5 Scheme 2</td><td>variable</td><td>UTF-8			





inspection,  
and forces verification.

The Sun JDK provided keytool will attempt to load a keystore even if no password is given, this is impossible for this version. (One might wonder about going to all this trouble and then having the password on the command line! New keytool anyone?).

<p>

In the first case, the keys are encrypted with 3-Key-TripleDES.

<p>

The third is a PKCS12 compatible keystore. PKCS12 provides a slightly different situation from the regular key store, the keystore password is currently the only password used for storing keys. Otherwise it supports all the functionality required for it to be used with the keytool. In some situations other libraries always expect to be dealing with Sun certificates, if this is the case use PKCS12-DEF, and the certificates produced by the key store will be made using the default provider. In the default case PKCS12 uses 3DES for key protection and 40 bit RC2 for protecting the certificates. It is also possible to use 3DES for both by using PKCS12-3DES-3DES or PKCS12-DEF-3DES-3DES as the KeyStore type.

<p>

There is an example program that produces PKCS12 files suitable for loading into browsers. It is in the package org.bouncycastle.jce.examples.

<p>

The fourth is the BCFKS key store which is a FIPS compliant key store which is also designed for general key storage and based on ASN.1. This key store type is encrypted and supports the use of SCRYPT and the storage of some symmetric key types.

<p>

### <h3>6.5 Additional support classes for Elliptic Curve.</h3>

<p>

There are no classes for supporting EC in the JDK prior to JDK 1.5. If you are using an earlier JDK you can find classes for using EC in the following packages:

<ul>

<li>org.bouncycastle.jce.spec</li>

<li>org.bouncycastle.jce.interfaces</li>

<li>org.bouncycastle.jce</li>

</ul>

### <h3>7.0 BouncyCastle S/MIME</h3>

To be able to fully compile and utilise the BouncyCastle S/MIME package (including the test classes) you need the jar files for the following APIs.

<ul>

<li>JUnit

- <a href="https://www.junit.org">https://www.junit.org</a></li>

<li>JavaMail - <a

```

href="https://java.sun.com/products/javamail/index.html">https://java.sun.com/products/javamail/index.html</a></li>
<li>The Java Activation Framework - <a
href="https://java.sun.com/products/javabeans/glasgow/jaf.html">https://java.sun.com/products/javabeans/glasgow/jaf.html</a></li>
</ul>

```

### 7.1 Setting up BouncyCastle S/MIME in JavaMail

The BouncyCastle S/MIME handlers may be set in JavaMail two ways.

```

<ul>
<li>STATICALLY<br>

```

Add the following entries to the mailcap file:

```

<pre>
application/pkcs7-signature;; x-java-content-handler=org.bouncycastle.mail.smime.handlers.pkcs7_signature
application/pkcs7-mime;; x-java-content-handler=org.bouncycastle.mail.smime.handlers.pkcs7_mime
application/x-pkcs7-signature;; x-java-content-handler=org.bouncycastle.mail.smime.handlers.x_pkcs7_signature
application/x-pkcs7-mime;; x-java-content-handler=org.bouncycastle.mail.smime.handlers.x_pkcs7_mime
multipart/signed;; x-java-content-handler=org.bouncycastle.mail.smime.handlers.multipart_signed
</pre>
</li>
<li>DYNAMICALLY<br>

```

The following code will add the BouncyCastle S/MIME handlers dynamically:

```

<pre>
import javax.activation.MailcapCommandMap;
import javax.activation.CommandMap;

public static void setDefaultMailcap()
{
    MailcapCommandMap _mailcap =
        (MailcapCommandMap)CommandMap.getDefaultCommandMap();

    _mailcap.addMailcap("application/pkcs7-signature;; x-java-content-
handler=org.bouncycastle.mail.smime.handlers.pkcs7_signature");
    _mailcap.addMailcap("application/pkcs7-mime;; x-java-content-
handler=org.bouncycastle.mail.smime.handlers.pkcs7_mime");
    _mailcap.addMailcap("application/x-pkcs7-signature;; x-java-content-
handler=org.bouncycastle.mail.smime.handlers.x_pkcs7_signature");
    _mailcap.addMailcap("application/x-pkcs7-mime;; x-java-content-
handler=org.bouncycastle.mail.smime.handlers.x_pkcs7_mime");
    _mailcap.addMailcap("multipart/signed;; x-java-content-
handler=org.bouncycastle.mail.smime.handlers.multipart_signed");

    CommandMap.setDefaultCommandMap(_mailcap);

```

```
}
</pre>
</li>
</ul>
</body>
</html>
```

Found in path(s):

\* /bcpkix-jdk18on-177-tar-gz/bcpkix-jdk18on-177/docs/specifications.html

No license file was found, but licenses were detected in source scan.

```
<html>
<head>
<title>The Bouncy Castle Crypto Package</title>
</head>
```

```
<body bgcolor="#ffffff" text="#000000#">
```

```
<center>
<h1>The Bouncy Castle Crypto Package</h1>
<font size=1>
<pre>
</pre>
</font>
</center>
```

The Bouncy Castle Crypto package is a Java implementation of cryptographic algorithms, it was developed by the Legion of the Bouncy Castle, a registered Australian Charity, with a little help! The Legion, and the latest goings on with this package, can be found at

<https://www.bouncycastle.org><https://www.bouncycastle.org>.

```
<p>
```

The Legion also gratefully acknowledges the contributions made to this package by others (see [here](#) for the current list). If you would like to contribute to our efforts please feel free to get in touch with us or visit our [donations page](https://www.bouncycastle.org/donate), sponsor some specific work, or purchase a support contract through

<https://www.cryptoworkshop.com> Crypto Workshop.

```
</p>
```

```
<p>
```

The package is organised so that it contains a light-weight API suitable for use in any environment (including the newly released J2ME) with the additional infrastructure to conform the algorithms to the JCE framework.

```
</p>
```

```
<p>
```

Except where otherwise stated, this software is distributed under a license based on the MIT X Consortium license. To view the license, [see here](/LICENSE.html). The OpenPGP library also includes a modified BZIP2 library which is licensed under the [Apache Software License](https://www.apache.org/licenses/),

Version 2.0</a>.

</p>

<p>

The current release notes for this package are

<a href="docs/releasenotes.html">here</a>.

</p>

<p>

The current specifications for this package are

<a href="docs/specifications.html">here</a>.

</p>

<p>

The current JavaDoc for the Bouncy Castle APIs can be found

<a href="javadoc/index.html">here</a>.

</p>

<p>

Additional documentation on

use of the classes can also be found in the <a href="docs/index.html">docs</a> directory.

</p>

## <h2>Examples and Tests</h2>

<p>

<p>To view some examples, look at the test programs in the packages:

<ul>

<li><p><b>org.bouncycastle.crypto.test</b>

<li><p><b>org.bouncycastle.jce.provider.test</b>

<li><p><b>org.bouncycastle.cms.test</b>

<li><p><b>org.bouncycastle.mail.smime.test</b>

<li><p><b>org.bouncycastle.openpgp.test</b>

<li><p><b>org.bouncycastle.tsp.test</b>

</ul>

<p>There are also some specific example programs for dealing with Attribute Certificates, PKCS12, SMIME and OpenPGP. They can be found in:

<ul>

<li><p><b>org.bouncycastle.jce.examples</b>

<li><p><b>org.bouncycastle.mail.smime.examples</b>

<li><p><b>org.bouncycastle.openpgp.examples</b>

<li><p><b>org.bouncycastle.x509.examples</b>

</ul>

<p>Finally there are also code <a href="https://www.wiley.com/WileyCDA/WileyAncillary/productCd-0764596330.html">examples</a>

from <a

href="https://www.amazon.com/exec/obidos/redirect?path=ASIN/0764596330&amp;link\_code=as2&amp;camp=1789&amp;tag=bouncycastle-20&amp;creative=9325">Beginning Cryptography with Java</a> which demonstrate both the use of the JCE/JCA and also some of the Bouncy Castle APIs.</p>

<p>

**Note 1:** The JCE classes are only distributed with the JDK 1.1, JDK 1.2, and JDK 1.3 JCE releases. The JDK 1.0, J2ME, and the JDK 1.1, JDK 1.2, JDK 1.3, JDK 1.4, and JDK 1.5 lightweight releases only include the Bouncy Castle lightweight cryptography API.

**Note 2:** The regression test for Diffie-Hellman is quite slow.

The clean room JCE, which will compile with everything from JDK 1.1 and up is in the jce/src/main/java directory.

The build scripts that come with the full distribution allow creation of the different releases by using the tree under src and test/src, excluding classes that are not appropriate and copying in the required compatibility classes from the directories containing

compatibility classes appropriate for the distribution.

If you want to try create a build for yourself, using your own environment, the best way to do it is to start with the build for the distribution you are interested in, make sure that builds, and then modify your build scripts to do the required exclusions and file copies for your setup, otherwise you are likely to get class not found exceptions. The final caveat to this is that as the j2me distribution includes some compatibility classes starting in the java package, you need to use an obfuscator to change the package names before attempting to import a midlet using the BC API.

## Mailing Lists

For those who are interested, there are 2 mailing lists

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links below and include the word subscribe in the message body. (To unsubscribe, replace **subscribe** with **unsubscribe** in the message body)

- [announce-crypto-request@bouncycastle.org](mailto:announce-crypto-request@bouncycastle.org)

This

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- [dev-crypto-request@bouncycastle.org](mailto:dev-crypto-request@bouncycastle.org)

This mailing list is for discussion of development of the package. This includes bugs, comments, requests for enhancements, questions about use or operation.

**NOTE:** You need to be subscribed to send mail to the above mailing list.

If you want to provide feedback, directly to the members of **The Legion** then please use [feedback-crypto@bouncycastle.org](mailto:feedback-crypto@bouncycastle.org), if you want to help this project survive please consider [donating](https://www.bouncycastle.org/donate) or getting a [support contract](https://www.cryptoworkshop.com).

Enjoy!

</html>

Found in path(s):

\* /bcpkix-jdk18on-177-tar-gz/bcpkix-jdk18on-177/index.html

## 1.37 libxml2 2.12.5

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## 1.38 fmt 10.1.1

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A. HISTORY OF THE SOFTWARE

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>)

in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3				
2.1.2	2002	PSF	yes	
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
2.4.2	2.4.1	2005	PSF	yes
2.4.3	2.4.2	2006	PSF	yes
2.4.4	2.4.3	2006	PSF	yes
2.5	2.4	2006	PSF	yes

2.5.1	2.5	2007	PSF	yes
2.5.2	2.5.1	2008	PSF	yes
2.5.3	2.5.2	2008	PSF	yes
2.6	2.5	2008	PSF	yes
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2.6.2	2.6.1	2009	PSF	yes
2.6.3	2.6.2	2009	PSF	yes
2.6.4	2.6.3	2009	PSF	yes
2.6.5	2.6.4	2010	PSF	yes
3.0	2.6	2008	PSF	yes
3.0.1	3.0	2009	PSF	yes
3.1	3.0.1	2009	PSF	yes
3.1.1	3.1	2009	PSF	yes
3.1.2	3.1.1	2010	PSF	yes
3.1.3	3.1.2	2010	PSF	yes
3.1.4	3.1.3	2011	PSF	yes
3.2	3.1	2011	PSF	yes
3.2.1	3.2	2011		
PSF	yes			
3.2.2	3.2.1	2011	PSF	yes
3.2.3	3.2.2	2012	PSF	yes
3.3.0	3.2	2012	PSF	yes

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## 1.39 nimbus-jose-jwt 9.0

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## 1.41 unbound 1.19.3

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