

# External Dependencies

## References

- [jqassistant](#)
- [Neo4j Python Driver](#)

## External Package Usage

### External Package

An external type has no `byteCodeVersion` since it only occurs as a dependency but wasn't analyzed itself (missing bytecode). Core Java types like `java.lang.Integer` and primitives like `int` are considered "build-in" and therefore aren't interpreted as "external" even though their byte code is also missing. A package is categorized as "external" if the types it contains are classified as external.

### External annotation dependency

The aforementioned classification encompasses external annotation dependencies as well. These dependencies introduce significantly less coupling and are not indispensable for compiling code. Without the external annotation the code would most probably behave differently. Hence, they are included in the first more overall and general tables and then left out in the later more specific ones.

### Table 1 - Top 20 most used external packages overall

This table shows the external packages that are used by the most different internal types overall. Additionally, it shows which types of the external package are actually used. External annotations are also listed.

Only the top 20 entries are shown. The whole table can be found in the following CSV report:

`External_package_usage_overall`

#### Columns:

- *externalPackageName* identifies the external package as described above
- *numberOfExternalCallerPackages* refers to the distinct packages that make use of the external package

- *numberOfExternalCallerTypes* refers to the distinct types that make use of the external package
- *numberOfExternalTypeCalls* includes every dependency to the types in the external package
- *numberOfExternalTypeCallsWeighted* includes every invocation or reference (sum of weights) to the types in the external package
- *allPackages* contains the total count of all analyzed packages in general
- *allTypes* contains the total count of all analyzed types in general
- *externalTypeNames* contains a list of actually utilized types of the external package

	externalPackageName	numberOfExternalCallerPackages	numberOfExternalCallerTypes	numberOfExternalTypeCalls	numberOfExternalTypeCallsWeighted
0	javax.annotation	63	310	342	16
1	org.slf4j	53	117	208	6
2	com.fasterxml.jackson.annotation	13	23	57	
3	javax.persistence	13	24	78	3
4	jakarta.persistence	8	22	69	3
5	org.hamcrest	5	27	61	4
6	com.github.kagkarlsson.scheduler	2	4	7	
7	com.github.kagkarlsson.scheduler.task	2	4	10	
8	com.thoughtworks.xstream.io	2	4	9	
9	org.jobrunr.scheduling	2	4	6	
10	org.quartz	2	9	39	2
11	reactor.core.publisher	2	18	35	1
12	com.fasterxml.jackson.core	1	3	4	
13	com.fasterxml.jackson.databind	1	7	15	
14	com.fasterxml.jackson.databind.node	1	2	3	
15	com.google.gson	1	1	4	
16	com.lmax.disruptor	1	7	9	
17	com.lmax.disruptor.dsl	1	4	5	
18	com.thoughtworks.xstream.converters	1	3	6	
19	com.thoughtworks.xstream.io.xml	1	2	4	

Table 1 Chart 1 - Most called external packages in % by types

External packages that are used less than 0.7% are grouped into the name "others" to get a cleaner chart with the most significant external packages and how often they are called in percent.



Table 1 Chart 2 - Most called external packages in % by packages

External packages that are used less than 0.7% are grouped into the name "others" to get a cleaner chart with the most significant external packages and how often they are called in percent.



Table 2 - Top 20 most used external packages grouped by their first 2 layers

This table shows external packages grouped by their first 2 layers that are used by the most different internal types overall including external annotations. For example, "javax.xml.stream" and "javax.xml.parsers" are grouped together to "javax.xml".

Additionally, it shows which types of the external packages are actually used.

Only the top 20 entries are shown. The whole table can be found in the following CSV report:

`External_second_level_package_usage_overall`

**Columns:**

- *externalSecondLevelPackageName* identifies the first 2 levels of the external package as described above
- *numberOfExternalCallerPackages* refers to the distinct packages that make use of the external package
- *numberOfExternalCallerTypes* refers to the distinct types that make use of the external package
- *numberOfExternalTypeCalls* includes every dependency to the types in the external package
- *numberOfExternalTypeCallsWeighted* includes every invocation or reference (sum of weights) to the types in the external package
- *allPackages* contains the total count of all analyzed packages in general
- *allTypes* contains the total count of all analyzed types in general
- *externalTypeNames* contains a list of actually utilized types of the external package

	externalSecondLevelPackageName	numberOfExternalCallerPackages	numberOfExternalCallerTypes	numberOfExternalTypeCalls	numberOfExternalTypeCallsWeight
0	javax.annotation	63	310	342	16%
1	org.slf4j	53	117	208	6%
2	com.fasterxml	14	30	85	1%
3	javax.persistence	13	24	78	3%
4	jakarta.persistence	8	22	69	3%
5	org.hamcrest	5	27	61	4%
6	com.github	2	6	19	1%
7	com.thoughtworks	2	8	31	1%
8	org.jobrunr	2	4	8	0%
9	org.junit	2	4	8	0%
10	org.quartz	2	9	40	2%
11	reactor.core	2	18	36	1%
12	com.google	1	1	4	0%
13	com.lmax	1	7	14	0%
14	jakarta.validation	1	2	5	0%
15	javax.cache	1	2	12	0%
16	javax.validation	1	2	5	0%
17	net.sf	1	2	8	0%
18	nu.xom	1	3	5	0%
19	org.dom4j	1	3	4	0%

Table 2 Chart 1 - Most called second level external packages in % by type

External package groups that are used less than 0.7% are grouped into the name "others" to get a cleaner chart with the most significant external packages and how often they are called in percent.

Top external package (grouped by first 2 layers) usage [%] by type



Table 2 Chart 2 - Most called second level external packages in % by package

External package groups that are used less than 0.7% are grouped into the name "others" to get a cleaner chart with the most significant external packages and how often they are called in percent.

Top external package (grouped by first 2 layers) usage [%] by package



## Table 3 - Top 20 most widely spread external packages

The following tables shows external packages that are used by many different artifacts with the highest number of artifacts first. External annotations are filtered out to only get those external packages that significantly add to coupling.

Statistics like minimum, maximum, average, median and standard deviation are provided for the number of packages and number of types in every artifact that uses the listed external package.

The intuition behind that is to find external package dependencies that are used in a widely spread manner. This should uncover libraries and frameworks and make it easier to distinguish them from external dependencies that are used for specific tasks. It can also be used to find external dependencies that are used sparsely regarding artifacts but are used in many different packages there. This could then be improved by applying a [Hexagonal architecture](#).

Only the top 20 entries are shown. The whole table can be found in the following CSV report:

`External_package_usage_spread`

### Columns:

- *externalPackageName* identifies the external package as defined above. All other columns contain aggregated data for this external package.
- *numberOfArtifacts* contains the number of artifacts that use the external package
- *sumNumberOfPackages* contains the sum of all packages that use the external package
- *min/max/med/avg/stdNumberOfPackages* provide statistics based on the number of packages of each artifact that uses the external package
- *min/max/med/avg/stdNumberOfPackagesPercentage* provide statistics in percent (%) based on the number of packages of each artifact that uses the external package
- *min/max/med/avg/stdNumberOfTypes* provide statistics based on the number of types of each artifact that uses the external package
- *min/max/med/avg/stdNumberOfPackagesPercentage* provide statistics in percent (%) based on the number of types of each artifact that uses the external package
- *someArtifactNames* contain some of the artifacts that contain the external package for reference

	externalPackageName	numberOfArtifacts	sumNumberOfPackages	minNumberOfPackages	maxNumberOfPackages	medNumberOfPackages	avgNu
0	org.slf4j	6	53	1	38	3.5	
1	jakarta.persistence	3	6	1	3	2.0	
2	javax.persistence	3	9	2	4	3.0	
3	AggregateEventPublisherImpl	1	1	1	1	1.0	
4	WeakValue	1	1	1	1	1.0	
5	com.fasterxml.jackson.annotation	1	3	3	3	3.0	
6	com.fasterxml.jackson.core	1	1	1	1	1.0	
7	com.fasterxml.jackson.databind	1	1	1	1	1.0	
8	com.fasterxml.jackson.databind.jsontype	1	1	1	1	1.0	
9	com.fasterxml.jackson.databind.module	1	1	1	1	1.0	

10 rows × 25 columns

Table 3a - Top 20 most widely spread external packages - number of internal packages

This table shows the top 20 most widely spread external packages focussing on the spread across the number of internal packages.

	externalPackageName	numberOfArtifacts	minNumberOfPackages	maxNumberOfPackages	medNumberOfPackages	avgNumberOfPackages	s
0	org.slf4j	6	1	38	3.5	8.833333	
1	jakarta.persistence	3	1	3	2.0	2.000000	
2	javax.persistence	3	2	4	3.0	3.000000	
3	AggregateEventPublisherImpl	1	1	1	1.0	1.000000	
4	WeakValue	1	1	1	1.0	1.000000	
5	com.fasterxml.jackson.annotation	1	3	3	3.0	3.000000	
6	com.fasterxml.jackson.core	1	1	1	1.0	1.000000	
7	com.fasterxml.jackson.databind	1	1	1	1.0	1.000000	
8	com.fasterxml.jackson.databind.jsontype	1	1	1	1.0	1.000000	
9	com.fasterxml.jackson.databind.module	1	1	1	1.0	1.000000	
10	com.fasterxml.jackson.databind.node	1	1	1	1.0	1.000000	
11	com.fasterxml.jackson.databind.type	1	1	1	1.0	1.000000	
12	com.fasterxml.jackson.datatype.jsr310	1	1	1	1.0	1.000000	
13	com.github.kagkarlsson.scheduler	1	2	2	2.0	2.000000	
14	com.github.kagkarlsson.scheduler.task	1	2	2	2.0	2.000000	
15	com.github.kagkarlsson.scheduler.task.helper	1	2	2	2.0	2.000000	
16	com.google.gson	1	1	1	1.0	1.000000	
17	com.lmax.disruptor	1	1	1	1.0	1.000000	
18	com.lmax.disruptor.dsl	1	1	1	1.0	1.000000	
19	com.thoughtworks.xstream	1	2	2	2.0	2.000000	

Table 3b - Top 20 most widely spread external packages - percentage of internal packages



This table shows the top 20 most widely spread external packages focussing on the spread across the percentage of internal packages.

	externalPackageName	numberOfArtifacts	minNumberOfPackagesPercentage	maxNumberOfPackagesPercentage	medNumberOfPackagesPerce
0	org.slf4j	6	25.0000	100.0000	59.68
1	jakarta.persistence	3	4.6875	20.0000	11.11
2	javax.persistence	3	6.2500	30.0000	22.22
3	AggregateEventPublisherImpl	1	12.5000	12.5000	12.50
4	WeakValue	1	100.0000	100.0000	100.00
5	com.fasterxml.jackson.annotation	1	4.6875	4.6875	4.68
6	com.fasterxml.jackson.core	1	1.5625	1.5625	1.56
7	com.fasterxml.jackson.databind	1	1.5625	1.5625	1.56
8	com.fasterxml.jackson.databind.jsontype	1	1.5625	1.5625	1.56
9	com.fasterxml.jackson.databind.module	1	1.5625	1.5625	1.56
10	com.fasterxml.jackson.databind.node	1	1.5625	1.5625	1.56
11	com.fasterxml.jackson.databind.type	1	1.5625	1.5625	1.56
12	com.fasterxml.jackson.datatype.jsr310	1	1.5625	1.5625	1.56
13	com.github.kagkarlsson.scheduler	1	3.1250	3.1250	3.12
14	com.github.kagkarlsson.scheduler.task	1	3.1250	3.1250	3.12
15	com.github.kagkarlsson.scheduler.task.helper	1	3.1250	3.1250	3.12
16	com.google.gson	1	12.5000	12.5000	12.50
17	com.lmax.disruptor	1	100.0000	100.0000	100.00
18	com.lmax.disruptor.dsl	1	100.0000	100.0000	100.00
19	com.thoughtworks.xstream	1	3.1250	3.1250	3.12

Table 3c - Top 20 most widely spread external packages - number of internal types

This table shows the top 20 most widely spread external packages focussing on the spread across the number of internal types.

	externalPackageName	numberOfArtifacts	minNumberOfTypes	maxNumberOfTypes	medNumberOfTypes	avgNumberOfTypes	stdNumberOfTyp
0	org.slf4j	6	2	78	8.5	19.500000	28.9257
1	jakarta.persistence	3	3	8	3.0	4.666667	2.8867
2	javax.persistence	3	3	8	3.0	4.666667	2.8867
3	AggregateEventPublisherImpl	1	1	1	1.0	1.000000	0.0000
4	WeakValue	1	1	1	1.0	1.000000	0.0000
5	com.fasterxml.jackson.annotation	1	5	5	5.0	5.000000	0.0000
6	com.fasterxml.jackson.core	1	3	3	3.0	3.000000	0.0000
7	com.fasterxml.jackson.databind	1	7	7	7.0	7.000000	0.0000
8	com.fasterxml.jackson.databind.jsontype	1	1	1	1.0	1.000000	0.0000
9	com.fasterxml.jackson.databind.module	1	1	1	1.0	1.000000	0.0000
10	com.fasterxml.jackson.databind.node	1	2	2	2.0	2.000000	0.0000
11	com.fasterxml.jackson.databind.type	1	3	3	3.0	3.000000	0.0000
12	com.fasterxml.jackson.datatype.jsr310	1	1	1	1.0	1.000000	0.0000
13	com.github.kagkarlsson.scheduler	1	4	4	4.0	4.000000	0.0000
14	com.github.kagkarlsson.scheduler.task	1	4	4	4.0	4.000000	0.0000
15	com.github.kagkarlsson.scheduler.task.helper	1	2	2	2.0	2.000000	0.0000
16	com.google.gson	1	1	1	1.0	1.000000	0.0000
17	com.lmax.disruptor	1	7	7	7.0	7.000000	0.0000
18	com.lmax.disruptor.dsl	1	4	4	4.0	4.000000	0.0000
19	com.thoughtworks.xstream	1	4	4	4.0	4.000000	0.0000

## Table 3d - Top 20 most widely spread external packages - percentage of internal types

This table shows the top 20 most widely spread external packages focussing on the spread across the percentage of internal types.

	externalPackageName	numberOfArtifacts	minNumberOfTypesPercentage	maxNumberOfTypesPercentage	medNumberOfTypesPercentage	avgNumberOfTypesPercentage
0	org.slf4j	6	2.298851	36.363636	10.224990	
1	jakarta.persistence	3	1.017812	2.255639	1.923077	
2	javax.persistence	3	1.017812	2.255639	1.923077	
3	AggregateEventPublisherImpl	1	1.149425	1.149425	1.149425	
4	WeakValue	1	4.545455	4.545455	4.545455	
5	com.fasterxml.jackson.annotation	1	0.636132	0.636132	0.636132	
6	com.fasterxml.jackson.core	1	0.381679	0.381679	0.381679	
7	com.fasterxml.jackson.databind	1	0.890585	0.890585	0.890585	
8	com.fasterxml.jackson.databind.jsontype	1	0.127226	0.127226	0.127226	
9	com.fasterxml.jackson.databind.module	1	0.127226	0.127226	0.127226	
10	com.fasterxml.jackson.databind.node	1	0.254453	0.254453	0.254453	
11	com.fasterxml.jackson.databind.type	1	0.381679	0.381679	0.381679	
12	com.fasterxml.jackson.datatype.jsr310	1	0.127226	0.127226	0.127226	
13	com.github.kagkarlsson.scheduler	1	0.508906	0.508906	0.508906	
14	com.github.kagkarlsson.scheduler.task	1	0.508906	0.508906	0.508906	
15	com.github.kagkarlsson.scheduler.task.helper	1	0.254453	0.254453	0.254453	
16	com.google.gson	1	1.149425	1.149425	1.149425	
17	com.lmax.disruptor	1	31.818182	31.818182	31.818182	
18	com.lmax.disruptor.dsl	1	18.181818	18.181818	18.181818	
19	com.thoughtworks.xstream	1	0.508906	0.508906	0.508906	

## Table 3 Chart 1 - Most widely spread external packages in % by types

External packages that are used less than 0.5% are grouped into the name "others" to get a cleaner chart with the most significant external packages.

Top external package usage spread [%] by type



Table 3 Chart 2 - Most widely spread external packages in % by packages

External packages that are used less than 0.5% are grouped into the name "others" to get a cleaner chart with the most significant external packages.

### Top external package usage spread [%] by package



## Table 4 - Top 20 most widely spread external packages grouped by their first 2 layers

This table shows external packages grouped by their first 2 layers that are used by many different artifacts with the highest number of artifacts first. External annotations are filtered out to only get those external packages that significantly add to coupling.

Statistics like minimum, maximum, average, median and standard deviation are provided for the number of packages and number of types in every artifact that uses the listed external package.

The intuition behind that is to find external package dependencies that are used in a widely spread manner. This should uncover libraries and frameworks and make it easier to distinguish them from external dependencies that are used for specific tasks. It can also be used to find external dependencies that are used sparsely regarding artifacts but are used in many different packages there. This could then be improved by applying a [Hexagonal architecture](#).

Only the top 20 entries are shown. The whole table can be found in the following CSV report:

`External_package_usage_spread`

### Columns:

- *externalPackageName* identifies the external package as defined above. All other columns contain aggregated data for this external package.
- *numberOfArtifacts* contains the number of artifacts that use the external package
- *sumNumberOfPackages* contains the sum of all packages that use the external package
- *min/max/med/avg/stdNumberOfPackages* provide statistics based on the number of packages of each artifact that uses the external package
- *min/max/med/avg/stdNumberOfPackagesPercentage* provide statistics in percent (%) based on the number of packages of each artifact that uses the external package
- *min/max/med/avg/stdNumberOfTypes* provide statistics based on the number of types of each artifact that uses the external package
- *min/max/med/avg/stdNumberOfPackagesPercentage* provide statistics in percent (%) based on the number of types of each artifact that uses the external package
- *someArtifactNames* contain some of the artifacts that contain the external package for reference

	externalSecondLevelPackageName	numberOfArtifacts	sumNumberOfPackages	minNumberOfPackages	maxNumberOfPackages	medNumberOfPackages	avgNun
0	org.slf4j	6	53	1	38	3.5	
1	jakarta.persistence	3	6	1	3	2.0	
2	javax.persistence	3	9	2	4	3.0	
3	AggregateEventPublisherImpl	1	1	1	1	1.0	
4	WeakValue	1	1	1	1	1.0	
5	com.fasterxml	1	4	4	4	4.0	
6	com.github	1	2	2	2	2.0	
7	com.google	1	1	1	1	1.0	
8	com.lmax	1	1	1	1	1.0	
9	com.thoughtworks	1	2	2	2	2.0	
10	jakarta.validation	1	1	1	1	1.0	
11	javax.cache	1	1	1	1	1.0	
12	javax.validation	1	1	1	1	1.0	
13	net.sf	1	1	1	1	1.0	
14	nu.xom	1	1	1	1	1.0	
15	org.dom4j	1	1	1	1	1.0	
16	org.ehcache	1	1	1	1	1.0	
17	org.hamcrest	1	5	5	5	5.0	
18	org.jobrunr	1	2	2	2	2.0	
19	org.junit	1	2	2	2	2.0	

20 rows × 25 columns

Table 4 Chart 1 - Most widely spread second level external packages in % by type

External package groups that are used less than 0.5% are grouped into the name "others" to get a cleaner chart with the most significant external packages and how often they are called in percent.

Top external package (grouped by first 2 layers) usage spread [%] by type



Table 4 Chart 2 - Most widely spread second level external packages in % by package

External package groups that are used less than 0.5% are grouped into the name "others" to get a cleaner chart with the most significant external packages and how often they are called in percent.

## Top external package (grouped by first 2 layers) usage spread [%] by package



## Table 5 - Top 20 least used external packages overall

This table identifies external packages that aren't used very often. This could help to find libraries that aren't actually needed or maybe easily replaceable. Some of them might be used sparsely on purpose for example as an adapter to an external library that is actually important. Thus, decisions need to be made on a case-by-case basis.

Only the last 20 entries are shown. The whole table can be found in the following CSV report:

`External_package_usage_overall`

### Columns:

- *externalPackageName* identifies the external package as described above
- *numberOfExternalTypeCalls* includes every invocation or reference to the types in the external package



	externalPackageName	numberOfExternalTypeCalls
0	org.junit.jupiter.api.extension	3
1	net.sf.ehcache.event	3
2	com.fasterxml.jackson.databind.node	3
3	javax.cache.configuration	3
4	org.testcontainers.containers	4
5	org.testcontainers.containers.wait.strategy	4
6	com.google.gson	4
7	com.fasterxml.jackson.core	4
8	com.thoughtworks.xstream.io.xml	4
9	org.testcontainers.utility	5
10	com.lmax.disruptor.dsl	5
11	jakarta.validation	5
12	com.thoughtworks.xstream.mapper	5
13	javax.validation	5
14	net.sf.ehcache	5
15	nu.xom	5
16	com.thoughtworks.xstream.converters	6
17	org.jobrunr.scheduling	6
18	com.github.kagkarlsson.scheduler	7
19	org.ehcache.event	8

**Table 6 - External usage per artifact sorted by highest external type rate descending**

The following table shows the most used external packages separately for each artifact including external annotations. The results are sorted by the artifacts with the highest external type usage rate descending.

The intention of this table is to find artifacts that use a lot of external dependencies in relation to their size and get all the external packages and their usage.

Only the last 40 entries are shown. The whole table can be found in the following CSV report:

[External\\_package\\_usage\\_per\\_artifact\\_sorted](#)

#### Columns:

- *artifactName* is used to group the the external package usage per artifact for a more detailed analysis.
- *externalPackageName* identifies the external package as described above
- *numberOfExternalTypeCaller* refers to the distinct types that make use of the external package
- *numberOfExternalTypeCalls* includes every invocation or reference to the types in the external package
- *numberOfTypesInArtifact* represents the total count of all analyzed types for the artifact
- *numberOfExternalTypesInArtifact* is the number of all external types that are used by the artifact
- *numberOfExternalPackagesInArtifact* is the number of all external packages that are used by the artifact
- *externalTypeRate* is the  $\text{numberOfExternalTypesInArtifact} / \text{numberOfTypesInArtifact} * 100$
- *externalTypeNames* contains a list of actually utilized types of the external package



	artifactName	externalPackageName	numberOfExternalTypeCaller	numberOfExternalTypeCalls	numberOfTypesInArtifact	numberOfExternalTypesIn
0	axon-disruptor-4.9.0	org.slf4j	12	22	22	
1	axon-disruptor-4.9.0	com.lmax.disruptor	9	29	22	
2	axon-disruptor-4.9.0	javax.annotation	6	23	22	
3	axon-disruptor-4.9.0	com.lmax.disruptor.dsl	5	22	22	
4	axon-disruptor-4.9.0	WeakValue	1	5	22	
5	axon-test-4.9.0	org.hamcrest	61	498	87	
6	axon-test-4.9.0	javax.annotation	10	52	87	
7	axon-test-4.9.0	org.testcontainers.utility	5	27	87	
8	axon-test-4.9.0	com.google.gson	4	9	87	
9	axon-test-4.9.0	org.slf4j	4	13	87	
10	axon-test-4.9.0	org.testcontainers.containers	4	15	87	
11	axon-test-4.9.0	org.testcontainers.containers.wait.strategy	4	5	87	
12	axon-test-4.9.0	org.junit.jupiter.api.extension	3	6	87	
13	axon-test-4.9.0	org.junit.runners.model	2	8	87	
14	axon-test-4.9.0	AggregateEventPublisherImpl	1	2	87	
15	axon-test-4.9.0	org.junit.jupiter.api	1	1	87	
16	axon-test-4.9.0	org.junit.rules	1	1	87	
17	axon-test-4.9.0	org.junit.runner	1	2	87	
18	axon-modelling-4.9.0	javax.annotation	37	132	156	
19	axon-modelling-4.9.0	javax.persistence	23	96	156	
20	axon-modelling-4.9.0	jakarta.persistence	18	90	156	
21	axon-modelling-4.9.0	org.slf4j	17	58	156	
22	axon-modelling-4.9.0	com.fasterxml.jackson.annotation	4	6	156	
23	axon-messaging-4.9.0	javax.annotation	247	1191	786	
24	axon-messaging-4.9.0	org.slf4j	141	440	786	
25	axon-messaging-4.9.0	com.fasterxml.jackson.annotation	53	81	786	
26	axon-messaging-4.9.0	javax.persistence	44	194	786	
27	axon-messaging-4.9.0	jakarta.persistence	40	188	786	
28	axon-messaging-4.9.0	org.quartz	39	232	786	

	artifactName	externalPackageName	numberOfExternalTypeCaller	numberOfExternalTypeCalls	numberOfTypesInArtifact	numberOfExternalTypesIn
29	axon-messaging-4.9.0	reactor.core.publisher	35	157	786	
30	axon-messaging-4.9.0	com.fasterxml.jackson.databind	15	73	786	
31	axon-messaging-4.9.0	org.reactivestreams	13	41	786	
32	axon-messaging-4.9.0	com.github.kagkarlsson.scheduler.task	10	52	786	
33	axon-messaging-4.9.0	com.thoughtworks.xstream.io	9	46	786	
34	axon-messaging-4.9.0	javax.cache.event	8	34	786	
35	axon-messaging-4.9.0	org.ehcache.event	8	33	786	
36	axon-messaging-4.9.0	com.github.kagkarlsson.scheduler	7	54	786	
37	axon-messaging-4.9.0	com.thoughtworks.xstream.converters	6	12	786	
38	axon-messaging-4.9.0	org.jobrunr.scheduling	6	37	786	
39	axon-messaging-4.9.0	com.thoughtworks.xstream.mapper	5	10	786	

## Table 7 - Artifacts and their external packages

The following table shows the artifacts with the highest external dependency usage broken down by each external package including external annotations. The results are sorted by the artifacts with the highest external package usage rate descending.

The intention of this table is to find artifacts that use a lot of external dependencies and show in detail which external packages are used by them and how many internal packages.

Only the last 30 entries are shown. The whole table can be found in the following CSV report:

[External\\_package\\_usage\\_per\\_artifact\\_and\\_external\\_package](#)

### Columns:

- *artifactName* is the name of the artifact with external dependencies (first grouping column)
- *artifactPackages* is the number of packages in the artifact
- *artifactTypes* is the number of types in the artifact
- *artifactExternalPackages* is the number of external packages used by the artifact
- *artifactExternalCallingPackages* is the number of packages that use external packages in the artifact
- *artifactExternalCallingPackagesRate* is  $\text{artifactExternalCallingPackages} / \text{artifactPackages} * 100\%$
- *externalPackageName* the name of the external package (second grouping column)
- *numberOfPackages* is the number of internal packages of the artifact that use the external packages
- *numberOfTypes* is the number of internal types of the artifact that use the external packages
- *packagesCallingExternalRate* is  $\text{numberOfPackages} / \text{artifactPackages} * 100\%$

- *typesCallingExternalRate* is  $\text{numberOfTypes} / \text{artifactTypes} * 100\%$
- *nameOfPackages* names of the internal packages that use the external package in the artifact
- *someTypeNames* some (10) names of the internal types that use the external package in the artifact

	artifactName	artifactPackages	artifactTypes	artifactExternalPackages	artifactExternalCallingPackages	artifactExternalCallingPackagesRate	externalPackageNames
0	axon-configuration-4.9.0	1	40	2	1	100.00	
1	axon-configuration-4.9.0	1	40	2	1	100.00	
2	axon-disruptor-4.9.0	1	22	5	1	100.00	
3	axon-disruptor-4.9.0	1	22	5	1	100.00	
4	axon-disruptor-4.9.0	1	22	5	1	100.00	
5	axon-disruptor-4.9.0	1	22	5	1	100.00	
6	axon-disruptor-4.9.0	1	22	5	1	100.00	
7	axon-test-4.9.0	8	87	13	7	87.50	
8	axon-test-4.9.0	8	87	13	7	87.50	
9	axon-test-4.9.0	8	87	13	7	87.50	
10	axon-test-4.9.0	8	87	13	7	87.50	Aggregate
11	axon-test-4.9.0	8	87	13	7	87.50	
12	axon-test-4.9.0	8	87	13	7	87.50	
13	axon-test-4.9.0	8	87	13	7	87.50	org.junit
14	axon-test-4.9.0	8	87	13	7	87.50	
15	axon-test-4.9.0	8	87	13	7	87.50	
16	axon-test-4.9.0	8	87	13	7	87.50	org
17	axon-test-4.9.0	8	87	13	7	87.50	org.test
18	axon-test-4.9.0	8	87	13	7	87.50	org.testcontainers.co
19	axon-test-4.9.0	8	87	13	7	87.50	org
20	axon-messaging-4.9.0	64	786	43	52	81.25	
21	axon-messaging-4.9.0	64	786	43	52	81.25	
22	axon-messaging-4.9.0	64	786	43	52	81.25	com.fasterx
23	axon-messaging-4.9.0	64	786	43	52	81.25	
24	axon-messaging-4.9.0	64	786	43	52	81.25	
25	axon-messaging-4.9.0	64	786	43	52	81.25	com.github.j
26	axon-messaging-4.9.0	64	786	43	52	81.25	com.github.kagka
27	axon-messaging-4.9.0	64	786	43	52	81.25	com.github.kagkarlsson
28	axon-messaging-4.9.0	64	786	43	52	81.25	com.

	artifactName	artifactPackages	artifactTypes	artifactExternalPackages	artifactExternalCallingPackages	artifactExternalCallingPackagesRate	e>
29	axon-messaging-4.9.0	64	786	43	52	81.25	com.th

## Table 7a - Artifacts and their external packages (first 2 levels)

The following table groups the external packages by their first two levels. For example `javax.xml.namespace` and `javax.xml.stream` will be grouped together to `javax.xml`.

	artifactName	artifactPackages	artifactTypes	artifactExternalPackagesFirst2Levels	artifactExternalCallingPackages	artifactExternalCallingPackagesRate	externalP
0	axon-configuration-4.9.0	1	40	2	1	100.00	
1	axon-configuration-4.9.0	1	40	2	1	100.00	
2	axon-disruptor-4.9.0	1	22	4	1	100.00	
3	axon-disruptor-4.9.0	1	22	4	1	100.00	
4	axon-disruptor-4.9.0	1	22	4	1	100.00	
5	axon-disruptor-4.9.0	1	22	4	1	100.00	
6	axon-test-4.9.0	8	87	7	7	87.50	
7	axon-test-4.9.0	8	87	7	7	87.50	
8	axon-test-4.9.0	8	87	7	7	87.50	
9	axon-test-4.9.0	8	87	7	7	87.50	
10	axon-test-4.9.0	8	87	7	7	87.50	Agg
11	axon-test-4.9.0	8	87	7	7	87.50	
12	axon-test-4.9.0	8	87	7	7	87.50	
13	axon-messaging-4.9.0	64	786	19	52	81.25	
14	axon-messaging-4.9.0	64	786	19	52	81.25	
15	axon-messaging-4.9.0	64	786	19	52	81.25	
16	axon-messaging-4.9.0	64	786	19	52	81.25	
17	axon-messaging-4.9.0	64	786	19	52	81.25	
18	axon-messaging-4.9.0	64	786	19	52	81.25	
19	axon-messaging-4.9.0	64	786	19	52	81.25	
20	axon-messaging-4.9.0	64	786	19	52	81.25	
21	axon-messaging-4.9.0	64	786	19	52	81.25	
22	axon-messaging-4.9.0	64	786	19	52	81.25	
23	axon-messaging-4.9.0	64	786	19	52	81.25	
24	axon-messaging-4.9.0	64	786	19	52	81.25	
25	axon-messaging-4.9.0	64	786	19	52	81.25	
26	axon-messaging-4.9.0	64	786	19	52	81.25	
27	axon-messaging-4.9.0	64	786	19	52	81.25	



	artifactName	artifactPackages	artifactTypes	artifactExternalPackagesFirst2Levels	artifactExternalCallingPackages	artifactExternalCallingPackagesRate	externalP
28	axon-messaging-4.9.0	64	786	19	52	81.25	
29	axon-messaging-4.9.0	64	786	19	52	81.25	

Table 7b - Top 15 external dependency using artifacts as columns with their external packages

The following table uses pivot to show the artifacts in columns, the external dependencies in rows and the number of internal packages as values.

artifactName	axon-messaging-4.9.0	axon-test-4.9.0	axon-modelling-4.9.0	axon-eventsourcing-4.9.0	axon-disruptor-4.9.0	axon-configuration-4.9.0
externalPackageName						
AggregateEventPublisherImpl	0	1	0	0	0	0
WeakValue	0	0	0	0	1	0
com.fasterxml.jackson.annotation	11	0	2	0	0	0
com.fasterxml.jackson.core	1	0	0	0	0	0
com.fasterxml.jackson.databind	1	0	0	0	0	0
com.fasterxml.jackson.databind.jsontype	1	0	0	0	0	0
com.fasterxml.jackson.databind.module	1	0	0	0	0	0
com.fasterxml.jackson.databind.node	1	0	0	0	0	0
com.fasterxml.jackson.databind.type	1	0	0	0	0	0
com.fasterxml.jackson.datatype.jsr310	1	0	0	0	0	0
com.github.kagkarlsson.scheduler	2	0	0	0	0	0
com.github.kagkarlsson.scheduler.task	2	0	0	0	0	0
com.github.kagkarlsson.scheduler.task.helper	2	0	0	0	0	0
com.google.gson	0	1	0	0	0	0
com.lmax.disruptor	0	0	0	0	1	0
com.lmax.disruptor.dsl	0	0	0	0	1	0
com.thoughtworks.xstream	2	0	0	0	0	0
com.thoughtworks.xstream.converters	1	0	0	0	0	0
com.thoughtworks.xstream.converters.collections	1	0	0	0	0	0
com.thoughtworks.xstream.io	2	0	0	0	0	0
com.thoughtworks.xstream.io.xml	1	0	0	0	0	0
com.thoughtworks.xstream.mapper	1	0	0	0	0	0
jakarta.persistence	4	0	2	2	0	0
jakarta.validation	1	0	0	0	0	0
javax.annotation	47	4	4	6	1	1
javax.cache	1	0	0	0	0	0
javax.cache.configuration	1	0	0	0	0	0
javax.cache.event	1	0	0	0	0	0
javax.persistence	7	0	3	3	0	0
javax.validation	1	0	0	0	0	0
net.sf.ehcache	1	0	0	0	0	0
net.sf.ehcache.event	1	0	0	0	0	0
nu.xom	1	0	0	0	0	0
org.dom4j	1	0	0	0	0	0
org.dom4j.io	1	0	0	0	0	0
org.ehcache.config	1	0	0	0	0	0
org.ehcache.core	1	0	0	0	0	0
org.ehcache.event	1	0	0	0	0	0
org.hamcrest	0	5	0	0	0	0
org.jobrunr.jobs	2	0	0	0	0	0
org.jobrunr.scheduling	2	0	0	0	0	0
org.junit.jupiter.api	0	1	0	0	0	0
org.junit.jupiter.api.extension	0	1	0	0	0	0
org.junit.rules	0	1	0	0	0	0
org.junit.runner	0	1	0	0	0	0
org.junit.runners.model	0	1	0	0	0	0
org.quartz	2	0	0	0	0	0
org.quartz.impl.matchers	1	0	0	0	0	0
org.reactivestreams	2	0	0	0	0	0
org.slf4j	38	2	6	5	1	1
org.testcontainers.containers	0	1	0	0	0	0
org.testcontainers.containers.wait.strategy	0	1	0	0	0	0
org.testcontainers.utility	0	1	0	0	0	0

artifactName	axon-messaging-4.9.0	axon-test-4.9.0	axon-modelling-4.9.0	axon-eventsourcing-4.9.0	axon-disruptor-4.9.0	axon-configuration-4.9.0
externalPackageName						
reactor.core	1	0	0	0	0	0
reactor.core.publisher	2	0	0	0	0	0
reactor.util.concurrent	1	0	0	0	0	0
reactor.util.context	1	0	0	0	0	0

Table 7c - Top 15 external dependency using artifacts as columns with their external packages (first 2 levels)

The following table uses pivot to show the artifacts in columns, the external package name grouped by its first two levels in rows and the number of internal packages as values. For example

`javax.xml.namespace` and `javax.xml.stream` will be grouped together to `javax.xml`.

artifactName	axon-messaging-4.9.0	axon-modelling-4.9.0	axon-eventsourcing-4.9.0	axon-test-4.9.0	axon-disruptor-4.9.0	axon-configuration-4.9.0
externalPackageNameFirst2Levels						
AggregateEventPublisherImpl	0	0	0	1	0	0
WeakValue	0	0	0	0	1	0
com.fasterxml	12	2	0	0	0	0
com.github	2	0	0	0	0	0
com.google	0	0	0	1	0	0
com.lmax	0	0	0	0	1	0
com.thoughtworks	2	0	0	0	0	0
jakarta.persistence	4	2	2	0	0	0
jakarta.validation	1	0	0	0	0	0
javax.annotation	47	4	6	4	1	1
javax.cache	1	0	0	0	0	0
javax.persistence	7	3	3	0	0	0
javax.validation	1	0	0	0	0	0
net.sf	1	0	0	0	0	0
nu.xom	1	0	0	0	0	0
org.dom4j	1	0	0	0	0	0
org.ehcache	1	0	0	0	0	0
org.hamcrest	0	0	0	5	0	0
org.jobrunr	2	0	0	0	0	0
org.junit	0	0	0	2	0	0
org.quartz	2	0	0	0	0	0
org.reactivestreams	2	0	0	0	0	0
org.slf4j	38	6	5	2	1	1
org.testcontainers	0	0	0	1	0	0
reactor.core	2	0	0	0	0	0
reactor.util	1	0	0	0	0	0

Table 7 Chart 1 - Top 15 external dependency using artifacts and their external packages stacked

The following chart shows the top 15 external package using artifacts and breaks down which external packages they use in how many different internal packages with stacked bars.

Note that every external dependency is counted separately so that if on internal package uses two external packages it will be displayed for both and so stacked twice.

<Figure size 640x480 with 0 Axes>

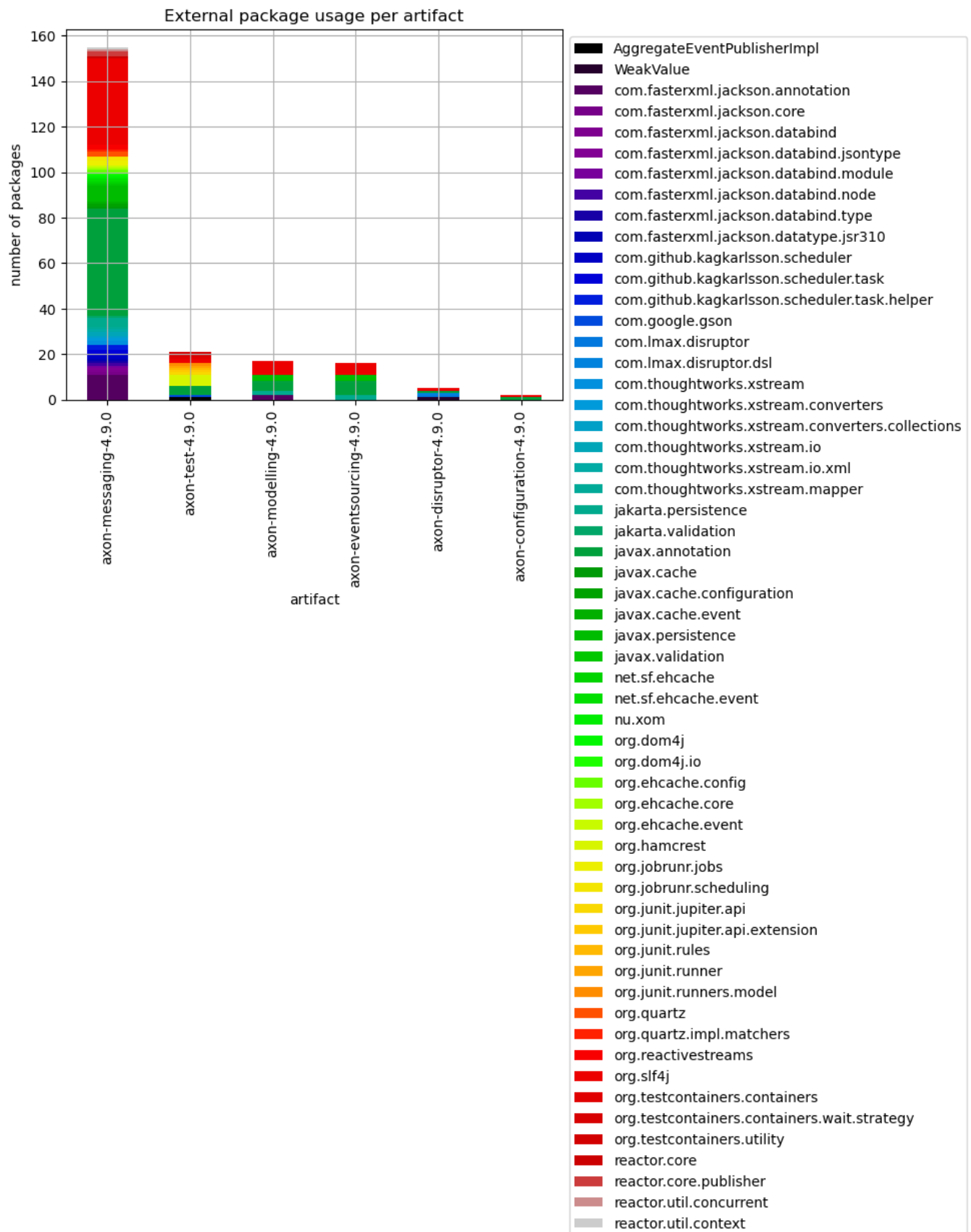


Table 7 Chart 2 - Top 15 external dependency using artifacts and their external packages (first 2 levels) stacked

The following chart shows the top 15 external package using artifacts and breaks down which external packages (first 2 levels) are used in how many different internal packages with stacked bars.

Note that every external dependency is counted separately so that if on internal package uses two external packages it will be displayed for both and so stacked twice.

<Figure size 640x480 with 0 Axes>

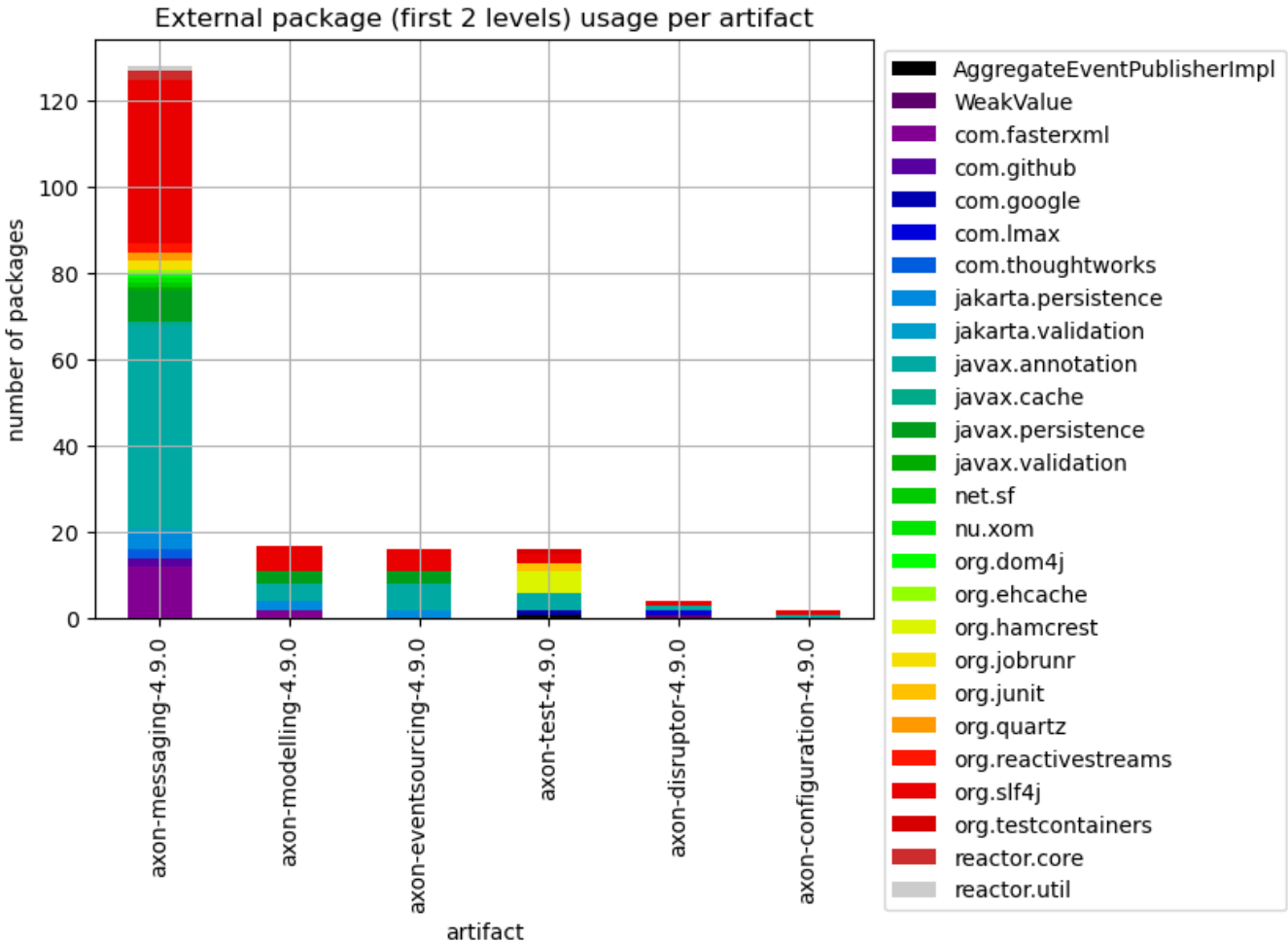


Table 8 - External usage per artifact

The following table shows the most used external packages separately for each artifact including external annotations. The results are grouped per artifact and sorted by the artifacts with the highest external type usage rate descending. Additionally, for each artifact the top 5 used external packages are listed in the top5ExternalPackages column.

The intention of this table is to find artifacts that use a lot of external dependencies in relation to their size and get an overview per artifact with the top 5 used external packages, the number of external types and packages used etc. .

Only the last 40 entries are shown. The whole table can be found in the following CSV report:

External\_package\_usage\_per\_artifact\_sorted\_top

## Columns:

- *artifactName* is used to group the the external package usage per artifact for a more detailed analysis.
- *numberOfTypesInArtifact* represents the total count of all analyzed types for the artifact
- *numberOfExternalTypesInArtifact* is the number of all external types that are used by the artifact
- *numberOfExternalPackagesInArtifact* is the number of all external packages that are used by the artifact
- *externalTypeRate* is the  $\text{numberOfExternalTypesInArtifact} / \text{numberOfTypesInArtifact} * 100$
- *numberOfExternalTypeCaller* refers to the distinct types that make use of the external package
- *numberOfExternalTypeCalls* includes every invocation or reference to the types in the external package
- *numberOfExternalPackages* is the number of distinct external packages used by the artifact
- *top5ExternalPackages* contains a list of the top 5 most used external packages of the artifact
- *someExternalTypes* contains a list of lists and is also mean't to provide some examples of external types used

	artifactName	numberOfTypesInArtifact	numberOfExternalTypesInArtifact	numberOfExternalPackagesInArtifact	externalTypeRate	numberOfExternalTypeCaller	nur
0	axon-disruptor-4.9.0	22	13	5	59.090909	33	
1	axon-test-4.9.0	87	28	13	32.183908	101	
2	axon-modelling-4.9.0	156	35	5	22.435897	99	
3	axon-messaging-4.9.0	786	155	43	19.720102	753	
4	axon-eventsourcing-4.9.0	133	25	4	18.796992	74	
5	axon-configuration-4.9.0	40	4	2	10.000000	24	

## Table 9 - External usage per artifact and package

This table lists internal packages and the artifacts they belong to that use many different external types of a specific external package without taking external annotations into account.

Only the last 40 entries are shown. The whole table can be found in the following CSV report:

[External\\_package\\_usage\\_per\\_artifact\\_and\\_package](#)

## Columns:

- *artifactName* that contains the type that calls the external package
- *fullPackageName* is the package within the artifact that contains the type that calls the external package
- *externalPackageName* identifies the external package as described above
- *numberOfExternalTypeCaller* refers to the distinct types that make use of the external package

- *numberOfExternalTypeCalls* includes every invocation or reference to the types in the external package
- *numberOfTypesInPackage* represents the total count of all types in that package
- *externalTypeNames* contains a list of actually utilized types of the external package
- *packageName* contains the name of the package (last part of *fullPackageName*)

	artifactName	fullPackageName	externalPackageName	numberOfExternalTypeCaller	numberOfExternalTypeCalls	num
0	axon-test-4.9.0	org.axonframework.test.matchers	org.hamcrest	38	188	
1	axon-messaging-4.9.0	org.axonframework.queryhandling	reactor.core.publisher	28	123	
2	axon-messaging-4.9.0	org.axonframework.deadline.quartz	org.quartz	20	137	
3	axon-messaging-4.9.0	org.axonframework.eventhandling.scheduling.quartz	org.quartz	19	95	
4	axon-messaging-4.9.0	org.axonframework.eventhandling	org.slf4j	16	57	
5	axon-messaging-4.9.0	org.axonframework.eventhandling.pooled	org.slf4j	15	70	
6	axon-messaging-4.9.0	org.axonframework.serialization.json	com.fasterxml.jackson.databind	15	73	
7	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	org.slf4j	12	22	
8	axon-configuration-4.9.0	org.axonframework.config	org.slf4j	11	32	
9	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	com.lmax.disruptor	9	29	
10	axon-test-4.9.0	org.axonframework.test.saga	org.hamcrest	9	91	
11	axon-eventsourcing-4.9.0	org.axonframework.eventsourcing.eventstore.leg...	org.slf4j	8	15	
12	axon-messaging-4.9.0	org.axonframework.common.caching	org.ehcache.event	8	33	
13	axon-messaging-4.9.0	org.axonframework.common.caching	javax.cache.event	8	34	
14	axon-messaging-4.9.0	org.axonframework.messaging.annotation	org.slf4j	8	15	
15	axon-messaging-4.9.0	org.axonframework.messaging.responsetypes	reactor.core.publisher	7	34	
16	axon-messaging-4.9.0	org.axonframework.queryhandling	org.slf4j	7	16	
17	axon-messaging-4.9.0	org.axonframework.queryhandling	org.reactivestreams	7	27	
18	axon-test-4.9.0	org.axonframework.test.aggregate	org.hamcrest	7	136	
19	axon-eventsourcing-4.9.0	org.axonframework.eventsourcing.eventstore	org.slf4j	6	9	
20	axon-messaging-4.9.0	org.axonframework.eventhandling.deadletter	org.slf4j	6	25	
21	axon-messaging-4.9.0	org.axonframework.messaging.responsetypes	org.reactivestreams	6	14	
22	axon-messaging-4.9.0	org.axonframework.serialization	com.thoughtworks.xstream.io	6	39	
23	axon-messaging-4.9.0	org.axonframework.serialization	com.thoughtworks.xstream.converters	6	12	
24	axon-modelling-4.9.0	org.axonframework.modelling.saga.repository.jpa	jakarta.persistence	6	68	
25	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	com.lmax.disruptor.dsl	5	22	
26	axon-eventsourcing-4.9.0	org.axonframework.eventsourcing.eventstore.jpa	jakarta.persistence	5	42	



	artifactName	fullPackageName	externalPackageName	numberOfExternalTypeCaller	numberOfExternalTypeCalls	num
27	axon-messaging-4.9.0	org.axonframework.common	org.slf4j	5	15	
28	axon-messaging-4.9.0	org.axonframework.common.caching	net.sf.ehcache	5	63	
29	axon-messaging-4.9.0	org.axonframework.deadline.dbscheduler	com.github.kagkarlsson.scheduler.task	5	27	
30	axon-messaging-4.9.0	org.axonframework.eventhandling.async	org.slf4j	5	16	
31	axon-messaging-4.9.0	org.axonframework.eventhandling.deadletter.jpa	jakarta.persistence	5	54	
32	axon-messaging-4.9.0	org.axonframework.eventhandling.scheduling.dbs...	com.github.kagkarlsson.scheduler.task	5	25	
33	axon-messaging-4.9.0	org.axonframework.eventhandling.tokenstore.jpa	jakarta.persistence	5	64	
34	axon-messaging-4.9.0	org.axonframework.eventhandling.tokenstore.leg...	javax.persistence	5	64	
35	axon-messaging-4.9.0	org.axonframework.messaging.interceptors	jakarta.validation	5	22	
36	axon-messaging-4.9.0	org.axonframework.messaging.interceptors.legac...	javax.validation	5	22	
37	axon-messaging-4.9.0	org.axonframework.serialization	com.thoughtworks.xstream.mapper	5	10	
38	axon-messaging-4.9.0	org.axonframework.serialization.xml	nu.xom	5	16	
39	axon-modelling-4.9.0	org.axonframework.modelling.saga.repository.le...	javax.persistence	5	66	

Table 10 - Top 20 external package usage per type

This table shows internal types that utilize the most different external types and packages. These have the highest probability of change depending on external libraries. A case-by-case approach is also advisable here because there could for example also be code units that encapsulate an external library and have this high count of external dependencies on purpose.

Only the last 20 entries are shown. The whole table can be found in the following CSV report:

[External\\_package\\_usage\\_per\\_type](#)

#### Columns:

- *artifactName* that contains the type that calls the external package
- *fullPackageName* is the package within the artifact that contains the type that calls external types
- *typeName* identifies the internal type within the package and artifact that calls external types
- *numberOfExternalTypeCaller* and *numberOfExternalTypes* refers to the distinct external types that are used by the internal type
- *numberOfExternalTypeCalls* includes every invocation or reference to the types in the external package
- *numberOfTypesInPackage* represents the total count of all types in that package
- *numberOfExternalPackages* shows how many different external packages are used by the internal type

- *externalPackageNames* contains the list of names of the different external packages that are used by the internal type
- *externalTypeNames* contains a list of actually utilized types of the external package
- *packageName* contains the name of the package (last part of *fullPackageName*)

	artifactName	fullPackageName	typeName	numberOfExternalTypeCaller	numberOfExternalType
0	axon-messaging-4.9.0	org.axonframework.serialization.json	JacksonSerializer	9	
1	axon-messaging-4.9.0	org.axonframework.deadline.dbscheduler	DbSchedulerDeadlineManager	12	
2	axon-messaging-4.9.0	org.axonframework.eventhandling.scheduling.dbs...	DbSchedulerEventScheduler	10	
3	axon-messaging-4.9.0	org.axonframework.serialization.xml	XStreamSerializer	7	
4	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	DisruptorCommandBus\$DisruptorRepository	4	
5	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	DisruptorCommandBus	6	
6	axon-messaging-4.9.0	org.axonframework.deadline.jobrunr	JobRunrDeadlineManager	7	
7	axon-messaging-4.9.0	org.axonframework.deadline.quartz	QuartzDeadlineManager	13	
8	axon-messaging-4.9.0	org.axonframework.eventhandling.scheduling.job...	JobRunrEventScheduler	6	
9	axon-messaging-4.9.0	org.axonframework.messaging.responsetypes	MultipleInstancesResponseType	7	
10	axon-messaging-4.9.0	org.axonframework.queryhandling	SimpleQueryUpdateEmitter	13	
11	axon-messaging-4.9.0	org.axonframework.queryhandling	SimpleQueryBus	6	
12	axon-messaging-4.9.0	org.axonframework.serialization	AbstractXStreamSerializer\$MetaDataConverter	6	
13	axon-messaging-4.9.0	org.axonframework.serialization	GapAwareTrackingTokenConverter\$ReflectivelyCon...	6	
14	axon-messaging-4.9.0	org.axonframework.serialization	GapAwareTrackingTokenConverter	6	
15	axon-messaging-4.9.0	org.axonframework.serialization.json	MetaDataDeserializer	6	
16	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	DisruptorCommandBus\$ExceptionHandler	3	
17	axon-disruptor-4.9.0	org.axonframework.disruptor.commandhandling	BlacklistDetectingCallback	4	
18	axon-eventsourcing-4.9.0	org.axonframework.eventsourcing.eventstore.jpa	JpaEventStorageEngine	6	
19	axon-eventsourcing-4.9.0	org.axonframework.eventsourcing.eventstore.leg...	JpaEventStorageEngine	6	

Table 11 - External package usage distribution per type

This table shows how many types use one external package, how many use two, etc. . This gives an overview of the distribution of external package calls and the overall coupling to external libraries. The higher the count of distinct external packages the lower should be the count of types that use them. Dependencies to external annotations are left out here.

More details about which types have the highest external package dependency usage can be in the tables 4 and 5 above.

Only the last 40 entries are shown. The whole table can be found in the following CSV report:

`External_package_usage_per_artifact_distribution`

### Columns:

- *artifactName* that contains the type that calls the external package
- *artifactTypes* the total count of types in the artifact
- *numberOfExternalPackages* the number of distinct external packages used
- *numberOfTypes* in the artifact where the *numberOfExternalPackages* applies
- *numberOfTypesPercentage* in the artifact where the *numberOfExternalPackages* applies in %

	artifactName	artifactPackages	artifactTypes	numberOfExternalPackages	numberOfPackages	numberOfTypes	typesCallingExternalRate	packagesCallingExternalRate
0	axon-messaging-4.9.0	64	786	42	44	155	19.720102	68.75
1	axon-modelling-4.9.0	10	156	3	7	12	7.692308	70.00
2	axon-test-4.9.0	8	87	12	6	36	41.379310	75.00
3	axon-eventsourcing-4.9.0	9	133	3	5	15	11.278195	55.56
4	axon-configuration-4.9.0	1	40	1	1	6	15.000000	100.00
5	axon-disruptor-4.9.0	1	22	4	1	10	45.454545	100.00

## Table 12 - External package usage per artifact grouped by number of internal packages

The following table shows the external package usage for every artifact grouped by the number of distinct internal dependent packages. The intention is to find external package usage spread across multiple internal packages in artifacts.

Artifacts that encapsulate external dependency calls in one internal package overall (or each) are easier to change if those external dependencies change and are most likely applying a [Hexagonal architecture](#). Artifacts that use external dependencies in multiple internal packages need more effort to adapt to changes of those external dependencies. On one hand this could be intended e.g. when using standardized libraries. On the other hand this might indicate higher than necessary coupling.

The whole table can be found in the following CSV report:

`External_package_usage_per_internal_package_count`

artifactName	axon-eventsourcing-4.9.0	axon-messaging-4.9.0	axon-modelling-4.9.0	axon-test-4.9.0
numberOfPackages				
2	22.222222	3.1250	20.0	25.0
3	33.333333	0.0000	30.0	0.0
4	0.000000	6.2500	40.0	50.0
5	55.555556	0.0000	0.0	62.5
6	66.666667	0.0000	60.0	0.0
7	0.000000	10.9375	0.0	0.0
11	0.000000	17.1875	0.0	0.0
38	0.000000	59.3750	0.0	0.0
47	0.000000	73.4375	0.0	0.0

**Table 13 - External package usage aggregated**

This table lists all artifacts and their external package dependencies usage aggregated over internal packages.

The intention behind this is to find artifacts that use an external dependency across multiple internal packages. This might be intended for frameworks and standardized libraries and helps to quantify how widely those are used. For some external dependencies it might be beneficial to only access it from one package and provide an abstraction for internal usage following a [Hexagonal architecture](#). Thus, this table may also help in finding application for the Hexagonal architecture or similar approaches (Domain Driven Design Anti Corruption Layer). After all it is easier to update or replace such external dependencies when they are used in specific areas and not all over the code.

Only the last 40 entries are shown. The whole table can be found in the following CSV report:

`External_package_usage_per_artifact_package_aggregated`

#### Columns:

- *artifactName* that contains the type that calls the external package
- *artifactPackages* is the total count of packages in the artifact
- *artifactTypes* is the total count of types in the artifact
- *numberOfExternalPackages* the number of distinct external packages used
- *[min,max,med,avg,std]NumberOfPackages* provide statistics based on each external package and its package usage within the artifact
- *[min,max,med,avg,std]NumberOfPackagesPercentage* provide statistics in % based on each external package and its package usage within the artifact in respect to the overall count of packages in the artifact
- *[min,max,med,avg,std]NumberOfTypes* provide statistics based on each external package and its type usage within the artifact
- *[min,max,med,avg,std]NumberOfTypePercentage* provide statistics in % based on each external package and its type usage within the artifact in respect to the overall count of packages in the artifact
- *numberOfTypes* in the artifact where the *numberOfExternalPackages* applies
- *numberOfTypesPercentage* in the artifact where the *numberOfExternalPackages* applies in %

Table 13a - External package usage aggregated - count of internal packages

	artifactName	artifactPackages	numberOfExternalPackages	minNumberOfPackages	medNumberOfPackages	avgNumberOfPackages	maxNumberOfPackages	stdNumberOfPackages
0	axon-messaging-4.9.0	64	42	1	1.0	2.285714	38	11.984722
1	axon-modelling-4.9.0	10	3	2	3.0	3.666667	6	3.464102
2	axon-eventsourcing-4.9.0	9	3	1	2.0	2.666667	5	6.350853
3	axon-test-4.9.0	8	12	1	1.0	1.416667	5	7.346407
4	axon-configuration-4.9.0	1	1	1	1.0	1.000000	1	0.000000
5	axon-disruptor-4.9.0	1	4	1	1.0	1.000000	1	3.162278

Table 13b - External package usage aggregated - percentage of internal packages

	artifactName	artifactPackages	numberOfExternalPackages	minNumberOfPackagesPercentage	medNumberOfPackagesPercentage	avgNumberOfPackagesPercentage	maxNumberOfPackagesPercentage	stdNumberOfPackagesPercentage
0	axon-messaging-4.9.0	64	42	1.562500	1.562500	3.5714	11.984722	11.984722
1	axon-modelling-4.9.0	10	3	20.000000	30.000000	36.6666	6.350853	6.350853
2	axon-eventsourcing-4.9.0	9	3	11.111111	22.222222	29.6296	6.350853	6.350853
3	axon-test-4.9.0	8	12	12.500000	12.500000	17.7083	7.346407	7.346407
4	axon-configuration-4.9.0	1	1	100.000000	100.000000	100.0000	0.000000	0.000000
5	axon-disruptor-4.9.0	1	4	100.000000	100.000000	100.0000	0.000000	0.000000

Table 13c - External package usage aggregated - count of internal types

	artifactName	artifactTypes	numberOfExternalPackages	minNumberOfTypes	medNumberOfTypes	avgNumberOfTypes	maxNumberOfTypes	stdNumberOfTypes
0	axon-messaging-4.9.0	786	42	1	2.5	5.309524	78	11.984722
1	axon-modelling-4.9.0	156	3	3	3.0	5.000000	9	3.464102
2	axon-eventsourcing-4.9.0	133	3	3	3.0	6.666667	14	6.350853
3	axon-test-4.9.0	87	12	1	1.5	3.833333	27	7.346407
4	axon-configuration-4.9.0	40	1	6	6.0	6.000000	6	0.000000
5	axon-disruptor-4.9.0	22	4	1	5.5	5.000000	8	3.162278

Table 13d - External package usage aggregated - percentage of internal types

	artifactName	artifactTypes	numberOfExternalPackages	minNumberOfTypesPercentage	medNumberOfTypesPercentage	avgNumberOfTypesPercentage	maxNumb
0	axon-messaging-4.9.0	786	42	0.127226	0.318066	0.675512	
1	axon-modelling-4.9.0	156	3	1.923077	1.923077	3.205128	
2	axon-eventsourcing-4.9.0	133	3	2.255639	2.255639	5.012531	
3	axon-test-4.9.0	87	12	1.149425	1.724138	4.406130	
4	axon-configuration-4.9.0	40	1	15.000000	15.000000	15.000000	
5	axon-disruptor-4.9.0	22	4	4.545455	25.000000	22.727273	

Table 13 Chart 1 - External package usage - max percentage of internal types

This chart shows per artifact the maximum percentage of internal packages (compared to all packages in that artifact) that use one specific external package.

**Example:** One artifact might use 10 external packages where 7 of them are used in one internal package, 2 of them are used in two packages and one external dependency is used in 5 packages. So for this artifact there will be a point at x = 10 (external packages used by the artifact) and 5 (max internal packages). Instead of the count the percentage of internal packages compared to all packages in that artifact is used to get a normalized plot.

<Figure size 640x480 with 0 Axes>

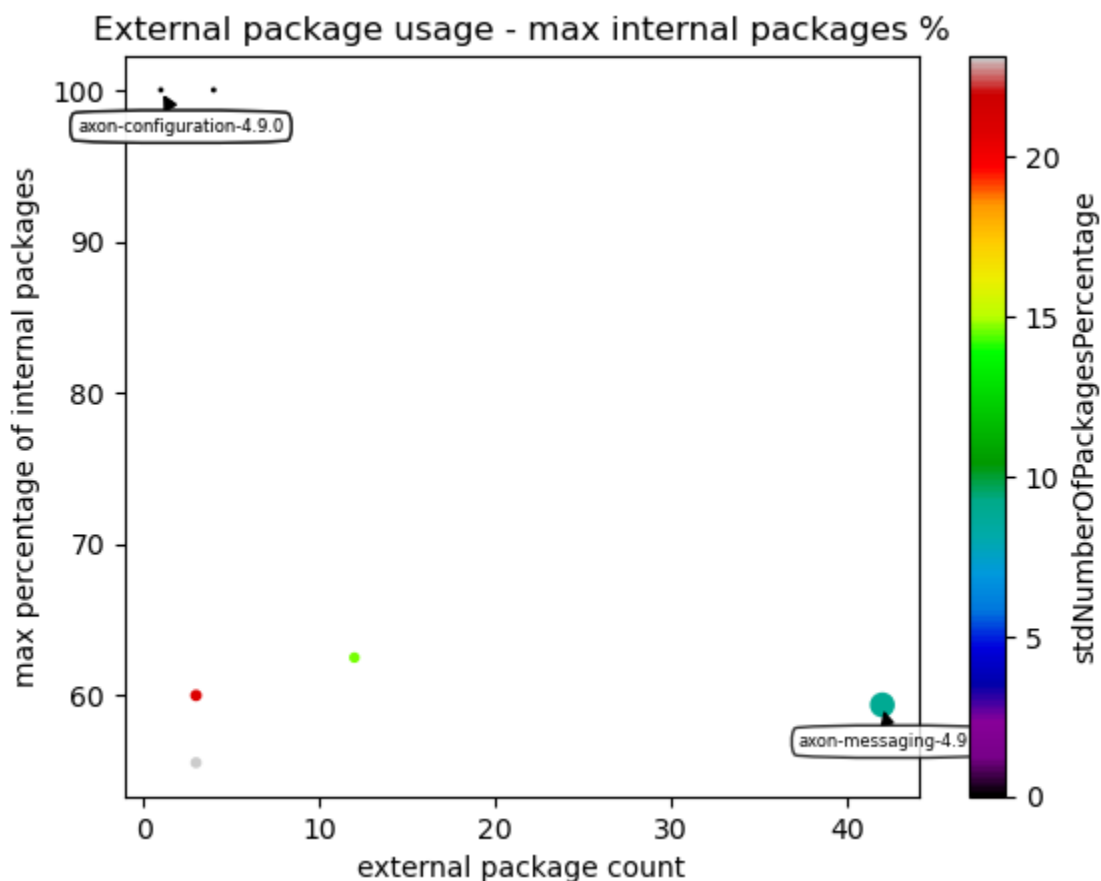


Table 13 Chart 2 - External package usage - median percentage of internal types

This chart shows per artifact the median (0.5 percentile) of internal packages (compared to all packages in that artifact) that use one specific external package.

**Example:** One artifact might use 9 external packages where 3 of them are used in 1 internal package, 3 of them are used in 2 package and the last 3 ones are used in 3 packages. So for this artifact there will be a point at x = 10 (external packages used by the artifact) and 2 (median internal packages). Instead of the count the percentage of internal packages compared to all packages in that artifact is used to get a normalized plot.

<Figure size 640x480 with 0 Axes>



## Maven POMs

Table 14 - Maven POMs and their declared dependencies

If Maven is used as for package and dependency management and a ".pom" file is included in the artifact, the following table shows the external dependencies that are declared there.

	pom.artifactId	pom.name	scope	dependency.optional	dependentArtifact.group	dependentArtifact.name
0	axon-configuration	Axon Framework - Configuration	test	True	io.projectreactor	reactor-core
1	axon-configuration	Axon Framework - Configuration	default	False	org.axonframework	axon-modelling
2	axon-configuration	Axon Framework - Configuration	default	False	\${project.groupId}	axon-eventsourcing
3	axon-configuration	Axon Framework - Configuration	default	False	org.axonframework	axon-messaging
4	axon-configuration	Axon Framework - Configuration	provided	False	com.google.code.findbugs	jsr305
...	...	...	...	...	...	...
111	axon-test	Axon Framework - Test Fixtures	default	False	org.junit.jupiter	junit-jupiter
112	axon-test	Axon Framework - Test Fixtures	test	False	javax.inject	javax.inject
113	axon-test	Axon Framework - Test Fixtures	default	True	org.testcontainers	testcontainers
114	axon-test	Axon Framework - Test Fixtures	test	False	jakarta.persistence	jakarta.persistence-api
115	axon-test	Axon Framework - Test Fixtures	default	True	org.hamcrest	hamcrest-library

116 rows × 6 columns