Visibility Metrics for Java

References

- Visibility Metrics and the Importance of Hiding Things
- Calculate metrics
- Controlling Access to Members of a Class
- Neo4j Python Driver

Relative Visibility Of Types

A Java class or interface may be declared with the modifier public, in which case it is visible to all classes everywhere. If a class or interface has no modifier (the default, also known as package-private), it is visible only within its own package.

The relative visibility is the number of inner components that are visible outside (public) divided by the number of all types:

$$relativevisibility = \frac{public\ types}{all\ types}$$

Using package protected types is one of many ways to improve encapsulation and implementation detail hiding.

How to apply the results

The relative visibility is between zero (all types are package protected) and one (all types are public). A value lower than one means that there are types that are declared package protected. The lower the value is, the better implementation details are hidden.

Non public classes can't be accessed from another package so they can be changed without affecting code in other packages. They clearly indicate functionality that only belongs to one package. This also motivates to use more classes and to split up code into smaller pieces with a single responsibility and reason to change.

Table 1a - Top 40 artifacts with lowest median of package protection encapsulation

This table shows the relative visibility statistics aggregated for all packages per artifact and focusses on artifacts with many packages and hardly any package protected types (lowest median, high visibility). Package protected types would help to improve encapsulation.

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

	artifact	all	public	min	max	average	percentile25	percentile50	percentile75	percentile90
0	axon-spring-boot-autoconfigure-4.10.3	75	68	0.793103	1.000000	0.954789	1.000000	1.000000	1.000000	1.000000
1	axon-tracing-opentelemetry-4.10.3	5	5	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
2	axon-messaging-4.10.3	787	645	0.136364	1.000000	0.867147	0.750000	0.973684	1.000000	1.000000
3	axon-server-connector-4.10.3	136	103	0.428571	1.000000	0.849850	0.784615	0.909091	1.000000	1.000000
4	axon-modelling-4.10.3	158	135	0.500000	1.000000	0.803352	0.737500	0.813187	0.889286	1.000000
5	axon-eventsourcing-4.10.3	133	98	0.500000	1.000000	0.771804	0.612903	0.785714	1.000000	1.000000
6	axon-test-4.10.3	87	65	0.473684	1.000000	0.781086	0.650000	0.775000	0.968750	1.000000
7	axon-configuration-4.10.3	41	28	0.682927	0.682927	0.682927	0.682927	0.682927	0.682927	0.682927
8	axon-disruptor-4.10.3	22	9	0.409091	0.409091	0.409091	0.409091	0.409091	0.409091	0.409091

Table 1b - Top 40 artifacts with highest median of package protection encapsulation

This table shows the relative visibility statistics aggregated for all packages per artifact and focusses on artifacts with many packages and the highest median of package protected types (low visibility). Package protected types help to improve encapsulation.

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

	artifact	all	public	min	max	average	percentile25	percentile50	percentile75	percentile90
0	axon-disruptor-4.10.3	22	9	0.409091	0.409091	0.409091	0.409091	0.409091	0.409091	0.409091
1	axon-configuration-4.10.3	41	28	0.682927	0.682927	0.682927	0.682927	0.682927	0.682927	0.682927
2	axon-test-4.10.3	87	65	0.473684	1.000000	0.781086	0.650000	0.775000	0.968750	1.000000
3	axon-eventsourcing-4.10.3	133	98	0.500000	1.000000	0.771804	0.612903	0.785714	1.000000	1.000000
4	axon-modelling-4.10.3	158	135	0.500000	1.000000	0.803352	0.737500	0.813187	0.889286	1.000000
5	axon-server-connector-4.10.3	136	103	0.428571	1.000000	0.849850	0.784615	0.909091	1.000000	1.000000
6	axon-messaging-4.10.3	787	645	0.136364	1.000000	0.867147	0.750000	0.973684	1.000000	1.000000
7	axon-spring-boot-autoconfigure-4.10.3	75	68	0.793103	1.000000	0.954789	1.000000	1.000000	1.000000	1.000000
8	axon-tracing-opentelemetry-4.10.3	5	5	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Table 1 Chart 1 - Relative visibility in artifacts

```
/home/runner/miniconda3/envs/codegraph/lib/python3.12/site-packages/pandas/plotting/_
matplotlib/core.py:1351: UserWarning: No data for colormapping provided via 'c'. Para
meters 'cmap' will be ignored
  scatter = ax.scatter(
/home/runner/miniconda3/envs/codegraph/lib/python3.12/site-packages/pandas/plotting/_
matplotlib/core.py:1351: UserWarning: No data for colormapping provided via 'c'. Para
meters 'cmap' will be ignored
  scatter = ax.scatter(
/home/runner/miniconda3/envs/codegraph/lib/python3.12/site-packages/pandas/plotting/_
matplotlib/core.py:1351: UserWarning: No data for colormapping provided via 'c'. Para
meters 'cmap' will be ignored
  scatter = ax.scatter(
```

```
<Figure size 640x480 with 0 Axes>
```

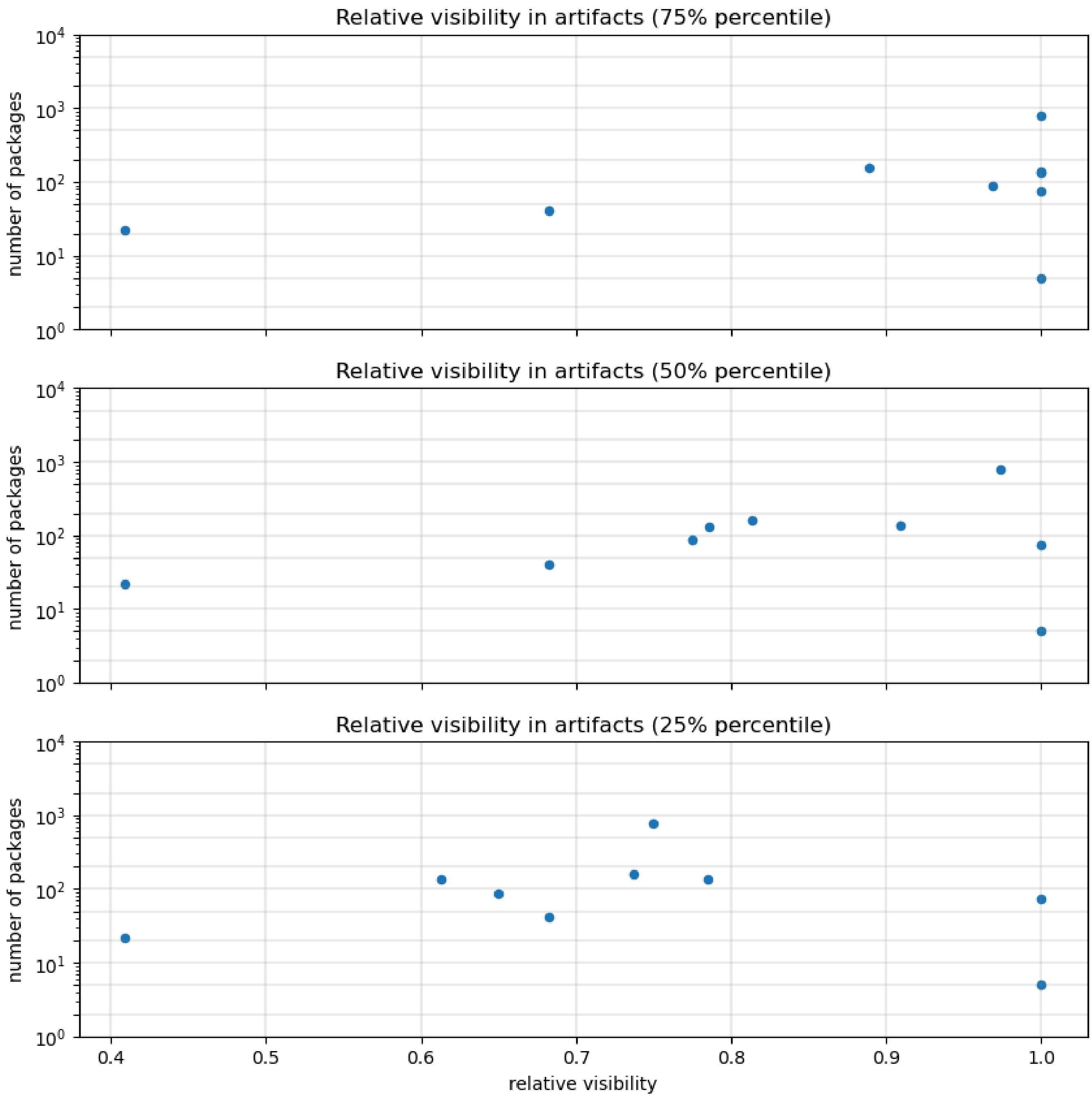

Table 2a - Top 40 packages with the highest visibility and lowest encapsulation

This table shows the relative visibility statistics per packages and artifact and focusses on packages with many types, hardly any package protected ones and therefore the highest relative visibility (lowest encapsulation). Package protected types would help to improve encapsulation.

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

	artifactName	fullQualifiedPackageName	packageName	publicTypes	allTypes	relativeVisibility
0	axon-modelling-4.10.3	org.axonframework.modelling.saga	saga	33	33	1.0
1	axon-spring-boot-autoconfigure-4.10.3	org.axonframework.springboot	springboot	25	25	1.0
2	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.eventstore.jdb...	statements	15	15	1.0
3	axon-messaging-4.10.3	org.axonframework.serialization.upcasting.event	event	12	12	1.0
4	axon-messaging-4.10.3	org.axonframework.lifecycle	lifecycle	10	10	1.0
5	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.conflictresolu...	conflictresolution	9	9	1.0
6	axon-messaging-4.10.3	org.axonframework.common.property	property	9	9	1.0
7	axon-spring-boot-autoconfigure-4.10.3	org.axonframework.springboot.util	util	9	9	1.0
8	axon-messaging-4.10.3	org.axonframework.messaging.interceptors	interceptors	8	8	1.0
9	axon-messaging-4.10.3	org.axonframework.messaging.responsetypes	responsetypes	8	8	1.0
10	axon-messaging-4.10.3	org.axonframework.commandhandling.distributed....	commandfilter	7	7	1.0
11	axon-messaging-4.10.3	org.axonframework.deadline.dbscheduler	dbscheduler	7	7	1.0
12	axon-messaging-4.10.3	org.axonframework.eventhandling.scheduling.dbs...	dbscheduler	7	7	1.0
13	axon-messaging-4.10.3	org.axonframework.serialization.json	json	7	7	1.0
14	axon-messaging-4.10.3	org.axonframework.eventhandling.tokenstore	tokenstore	7	7	1.0
15	axon-messaging-4.10.3	org.axonframework.serialization.xml	xml	7	7	1.0
16	axon-messaging-4.10.3	org.axonframework.tracing.attributes	attributes	6	6	1.0
17	axon-messaging-4.10.3	org.axonframework.eventhandling.scheduling.quartz	quartz	6	6	1.0
18	axon-messaging-4.10.3	org.axonframework.serialization.upcasting	upcasting	6	6	1.0
19	axon-messaging-4.10.3	org.axonframework.serialization.converters	converters	5	5	1.0
20	axon-messaging-4.10.3	org.axonframework.eventhandling.gateway	gateway	5	5	1.0
21	axon-messaging-4.10.3	org.axonframework.queryhandling.registration	registration	5	5	1.0
22	axon-test-4.10.3	org.axonframework.test.eventscheduler	eventscheduler	5	5	1.0
23	axon-tracing-opentelemetry-4.10.3	org.axonframework.tracing.opentelemetry	opentelemetry	5	5	1.0
24	axon-messaging-4.10.3	org.axonframework.commandhandling.callbacks	callbacks	4	4	1.0
25	axon-messaging-4.10.3	org.axonframework.messaging.correlation	correlation	4	4	1.0
26	axon-messaging-4.10.3	org.axonframework.deadline.jobrunr	jobrunr	4	4	1.0
27	axon-messaging-4.10.3	org.axonframework.common.jpa	jpa	4	4	1.0
28	axon-messaging-4.10.3	org.axonframework.eventhandling.tokenstore.jpa	jpa	4	4	1.0
29	axon-messaging-4.10.3	org.axonframework.common.legacyjpa	legacyjpa	4	4	1.0
30	axon-messaging-4.10.3	org.axonframework.deadline.quartz	quartz	4	4	1.0
31	axon-test-4.10.3	org.axonframework.test.deadline	deadline	4	4	1.0
32	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.snapshotting	snapshotting	3	3	1.0
33	axon-messaging-4.10.3	org.axonframework.eventhandling.scheduling.job...	jobrunr	3	3	1.0
34	axon-messaging-4.10.3	org.axonframework.eventhandling.scheduling	scheduling	3	3	1.0
35	axon-messaging-4.10.3	org.axonframework.util	util	3	3	1.0
36	axon-server-connector-4.10.3	org.axonframework.axonserver.connector.processor	processor	3	3	1.0
37	axon-server-connector-4.10.3	org.axonframework.axonserver.connector.event.util	util	3	3	1.0
38	axon-messaging-4.10.3	org.axonframework.eventhandling.tokenstore.leg...	legacyjpa	2	2	1.0
39	axon-messaging-4.10.3	org.axonframework.messaging.interceptors.legac...	legacyvalidation	2	2	1.0

Table 2b - Top 40 packages with the lowest visibility and highest encapsulation

This table shows the relative visibility statistics per packages and artifact and focusses on packages with many types, many package protected ones and therefore the lowest relative visibility (highest encapsulation). Package protected types help to improve encapsulation. Zero percent visibility and therefore packages with no public visible type are suspicious to be dead code.

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

`Relative_visibility_public_types_to_all_types_per_package`

	artifactName	fullQualifiedPackageName	packageName	publicTypes	allTypes	relativeVisibility
0	axon-messaging-4.10.3	org.axonframework.eventhandling.pooled	pooled	3	22	0.136364
1	axon-messaging-4.10.3	org.axonframework.eventhandling.deadletter	deadletter	2	5	0.400000
2	axon-disruptor-4.10.3	org.axonframework.disruptor.commandhandling	commandhandling	9	22	0.409091
3	axon-server-connector-4.10.3	org.axonframework.axonserver.connector.query	query	9	21	0.428571
4	axon-test-4.10.3	org.axonframework.test.aggregate	aggregate	9	19	0.473684
5	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.eventstore.leg...	legacyjpa	5	10	0.500000
6	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.eventstore.inm...	inmemory	1	2	0.500000
7	axon-messaging-4.10.3	org.axonframework.eventhandling.tokenstore.inm...	inmemory	1	2	0.500000
8	axon-modelling-4.10.3	org.axonframework.modelling.saga.repository.in...	inmemory	1	2	0.500000
9	axon-messaging-4.10.3	org.axonframework.commandhandling.gateway	gateway	19	34	0.558824
10	axon-messaging-4.10.3	org.axonframework.eventhandling.async	async	9	15	0.600000
11	axon-messaging-4.10.3	org.axonframework.common.caching	caching	9	15	0.600000
12	axon-messaging-4.10.3	org.axonframework.eventhandling.replay	replay	6	10	0.600000
13	axon-messaging-4.10.3	org.axonframework.deadline.annotation	annotation	3	5	0.600000
14	axon-test-4.10.3	org.axonframework.test	test	3	5	0.600000
15	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.eventstore	eventstore	19	31	0.612903
16	axon-server-connector-4.10.3	org.axonframework.axonserver.connector.event.axon	axon	20	31	0.645161
17	axon-test-4.10.3	org.axonframework.test.saga	saga	14	21	0.666667
18	axon-messaging-4.10.3	org.axonframework.common.annotation	annotation	2	3	0.666667
19	axon-messaging-4.10.3	org.axonframework.common.stream	stream	2	3	0.666667
20	axon-modelling-4.10.3	org.axonframework.modelling.saga.repository.le...	legacyjpa	2	3	0.666667
21	axon-configuration-4.10.3	org.axonframework.config	config	28	41	0.682927
22	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing	eventsourcing	29	42	0.690476
23	axon-messaging-4.10.3	org.axonframework.messaging.unitofwork	unitofwork	10	14	0.714286
24	axon-messaging-4.10.3	org.axonframework.common.lock	lock	8	11	0.727273
25	axon-modelling-4.10.3	org.axonframework.modelling.saga.repository	repository	11	15	0.733333
26	axon-messaging-4.10.3	org.axonframework.tracing	tracing	14	19	0.736842
27	axon-messaging-4.10.3	org.axonframework.messaging.annotation	annotation	40	54	0.740741
28	axon-messaging-4.10.3	org.axonframework.queryhandling.annotation	annotation	3	4	0.750000
29	axon-messaging-4.10.3	org.axonframework.eventhandling.scheduling.java	java	3	4	0.750000
30	axon-messaging-4.10.3	org.axonframework.common.transaction	transaction	3	4	0.750000
31	axon-modelling-4.10.3	org.axonframework.modelling.saga.metamodel	metamodel	3	4	0.750000
32	axon-test-4.10.3	org.axonframework.test.server	server	3	4	0.750000
33	axon-modelling-4.10.3	org.axonframework.modelling.command.inspection	inspection	20	26	0.769231
34	axon-server-connector-4.10.3	org.axonframework.axonserver.connector.util	util	20	26	0.769231
35	axon-messaging-4.10.3	org.axonframework.deadline	deadline	10	13	0.769231
36	axon-eventsourcing-4.10.3	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	11	14	0.785714
37	axon-spring-boot-autoconfigure-4.10.3	org.axonframework.springboot.autoconfig	autoconfig	23	29	0.793103
38	axon-server-connector-4.10.3	org.axonframework.axonserver.connector.heartbeat	heartbeat	4	5	0.800000
39	axon-spring-boot-autoconfigure-4.10.3	org.axonframework.springboot.service.connection	connection	4	5	0.800000

Table 2 Chart 1 - Relative visibility of packages

```
/home/runner/miniconda3/envs/codegraph/lib/python3.12/site-packages/pandas/plotting/_
matplotlib/core.py:1351: UserWarning: No data for colormapping provided via 'c'. Para
meters 'cmap' will be ignored
  scatter = ax.scatter(
```

<Figure size 640x480 with 0 Axes>