Object Oriented Design Quality Metrics

References

- [Analyze java package metrics in a graph database](#)
- [Calculate metrics](#)
- [jqassistant](#)
- [notebook walks through examples for integrating various packages with Neo4j](#)
- [OO Design Quality Metrics](#)
- [A Validation of Martin's Metric](#)
- [Neo4j Python Driver](#)

Incoming Dependencies

Incoming dependencies are also denoted as "Fan-in", "Afferent Coupling" or "in-degree". These are the ones that use the listed package.

If these packages get changed, the incoming dependencies might be affected by the change. The more incoming dependencies, the harder it gets to change the code without the need to adapt the dependent code ("rigid code"). Even worse, it might affect the behavior of the dependent code in an unwanted way ("fragile code").

Since Java Packages are organized hierarchically, incoming dependencies can be count for every package in isolation or by including all of its sub-packages. The latter one is done without top level packages like for example "org" or "org.company" by assuring that only packages are considered that have other packages or types in the same hierarchy level ("siblings").

Table 1a

- Show the top 20 Java Packages with the most incoming dependencies
- Set the "incomingDependencies" properties on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	incomingDependencies	incomingDependenciesWeight	incomingDependentTypes	i
0	axon-messaging-4.10.0	org.axonframework.messaging	messaging	9924	29253	363	
1	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	5871	25317	329	
2	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	1903	6289	137	
3	axon-messaging-4.10.0	org.axonframework.serialization	serialization	1655	6748	175	
4	axon-messaging-4.10.0	org.axonframework.messaging.annotation	annotation	1079	4042	154	
5	axon-messaging-4.10.0	org.axonframework.common	common	1043	2446	367	
6	axon-messaging-4.10.0	org.axonframework.tracing	tracing	635	2923	109	
7	axon-messaging-4.10.0	org.axonframework.queryhandling	queryhandling	415	1698	80	
8	axon-configuration-4.10.0	org.axonframework.config	config	384	3033	62	
9	axon-messaging-4.10.0	org.axonframework.common.transaction	transaction	368	1103	89	
10	axon-modelling-4.10.0	org.axonframework.modelling.command	command	273	938	81	
11	axon-modelling-4.10.0	org.axonframework.modelling.saga	saga	263	1142	62	
12	axon-messaging-4.10.0	org.axonframework.messaging.unitofwork	unitofwork	259	1085	83	
13	axon-messaging-4.10.0	org.axonframework.deadline	deadline	247	1243	45	
14	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	235	1288	27	
15	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore	eventstore	205	816	70	
16	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	205	1150	39	
17	axon-messaging-4.10.0	org.axonframework.monitoring	monitoring	199	531	41	
18	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing	eventsourcing	148	580	47	
19	axon-server-connector-4.10.0	org.axonframework.axonserver.connector	connector	117	571	55	

Table 1b

- Show the top 20 Java Packages including their sub-packages with the most incoming dependencies
- Set the property "incomingDependenciesIncludingSubpackages" on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	incomingDependencies	incomingDependenciesWeight	incomingDependentTypes	inc
0	axon-messaging-4.10.0	org.axonframework.messaging	messaging	8873	28110	372	
1	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	3663	13842	173	
2	axon-messaging-4.10.0	org.axonframework.serialization	serialization	1500	6108	131	
3	axon-messaging-4.10.0	org.axonframework.common	common	1458	4039	405	
4	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	1015	3962	70	
5	axon-messaging-4.10.0	org.axonframework.messaging.annotation	annotation	960	3695	109	
6	axon-messaging-4.10.0	org.axonframework.tracing	tracing	565	2627	85	
7	axon-messaging-4.10.0	org.axonframework.common.transaction	transaction	362	1089	86	
8	axon-configuration-4.10.0	org.axonframework.config	config	265	1808	26	
9	axon-messaging-4.10.0	org.axonframework.queryhandling	queryhandling	252	1005	33	
10	axon-messaging-4.10.0	org.axonframework.messaging.unitofwork	unitofwork	222	868	72	
11	axon-messaging-4.10.0	org.axonframework.monitoring	monitoring	189	501	36	
12	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing	eventsourcing	173	645	28	
13	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	173	1018	24	
14	axon-modelling-4.10.0	org.axonframework.modelling.command	command	163	537	39	
15	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore	eventstore	144	464	35	
16	axon-messaging-4.10.0	org.axonframework.deadline	deadline	128	764	22	
17	axon-modelling-4.10.0	org.axonframework.modelling.saga	saga	97	277	23	
18	axon-messaging-4.10.0	org.axonframework.lifecycle	lifecycle	95	262	27	
19	axon-messaging-4.10.0	org.axonframework.messaging.responsetypes	responsetypes	90	372	20	

Outgoing Dependencies

Outgoing dependencies are also denoted as "Fan-out", "Efferent Coupling" or "out-degree". These are the ones that are used by the listed package.

Code from other packages and libraries you're depending on (outgoing) might change over time. The more outgoing changes, the more likely and frequently code changes are needed. This involves time and effort which can be reduced by automation of tests and version updates. Automated tests are crucial to reveal updates, that change the behavior of the code unexpectedly ("fragile code"). As soon as more

effort is required, keeping up becomes difficult ("rigid code"). Not being able to use a newer version might not only restrict features, it can get problematic if there are security issues. This might force you to take "fast but ugly" solutions into account which further increases technical dept.

Since Java Packages are organized hierarchically, outgoing dependencies can be count for every package in isolation or by including all of its sub-packages. The latter one is done without top level packages like for example "org" or "org.company" by assuring that only packages are considered that have other packages or types in the same hierarchy level ("siblings").

Table 2a

- Show the top 20 Java Packages with the most outgoing dependencies
- Set the "outgoingDependencies" properties on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	outgoingDependencies	outgoingDependenciesWeight	outgoingDependentTypes
0	axon-configuration-4.10.0	org.axonframework.config	config	9870	37642	241
1	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.autoconfig	autoconfig	5721	20298	236
2	axon-test-4.10.0	org.axonframework.test.aggregate	aggregate	2210	7997	92
3	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.query	query	1569	6983	91
4	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	1563	6457	160
5	axon-disruptor-4.10.0	org.axonframework.disruptor.commandhandling	commandhandling	1453	5180	84
6	axon-test-4.10.0	org.axonframework.test.saga	saga	1419	4096	81
7	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	1340	6712	51
8	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event.axon	axon	1144	4119	96
9	axon-messaging-4.10.0	org.axonframework.queryhandling	queryhandling	1141	5254	86
10	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing	eventsourcing	1009	3348	95
11	axon-messaging-4.10.0	org.axonframework.eventhandling.pooled	pooled	962	4431	57
12	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.command	command	932	3060	62
13	axon-modelling-4.10.0	org.axonframework.modelling.command	command	842	3161	94
14	axon-modelling-4.10.0	org.axonframework.modelling.command.inspection	inspection	781	3026	73
15	axon-messaging-4.10.0	org.axonframework.commandhandling.distributed	distributed	738	2227	74
16	axon-server-connector-4.10.0	org.axonframework.axonserver.connector	connector	719	3660	81
17	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	691	1832	74
18	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore	eventstore	613	1981	65
19	axon-messaging-4.10.0	org.axonframework.eventhandling.deadletter.jdbc	jdbc	560	3512	49

Table 2b

- Show the top 20 Java Packages including their sub-packages with the most outgoing dependencies
- Set the property "outgoingDependenciesIncludingSubpackages" on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	outgoingDependencies	outgoingDependenciesWeight	outgoingDependentTypes
0	axon-configuration-4.10.0	org.axonframework.config	config	595	1831	201
1	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	585	2116	106
2	axon-server-connector-4.10.0	org.axonframework.axonserver.connector	connector	413	1504	149
3	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing	eventsourcing	380	1319	95
4	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.autoconfig	autoconfig	354	1139	227
5	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot	springboot	316	969	202
6	axon-test-4.10.0	org.axonframework.test	test	273	793	99
7	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore	eventstore	245	914	58
8	axon-modelling-4.10.0	org.axonframework.modelling.command	command	230	759	63
9	axon-messaging-4.10.0	org.axonframework.eventhandling.deadletter	deadletter	207	993	57
10	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	196	485	67
11	axon-messaging-4.10.0	org.axonframework.deadline	deadline	190	608	48
12	axon-messaging-4.10.0	org.axonframework.messaging	messaging	188	493	27
13	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.query	query	180	697	72
14	axon-messaging-4.10.0	org.axonframework.queryhandling	queryhandling	177	614	51
15	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event	event	165	542	72
16	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event.axon	axon	165	549	73
17	axon-modelling-4.10.0	org.axonframework.modelling.saga	saga	155	474	58
18	axon-test-4.10.0	org.axonframework.test.aggregate	aggregate	149	550	74
19	axon-disruptor-4.10.0	org.axonframework.disruptor.commandhandling	commandhandling	130	436	62

Instability

$$Instability = \frac{Outgoing\ Dependencies}{Outgoing\ Dependencies + Incoming\ Dependencies}$$

Instability is expressed as the ratio of the number of outgoing dependencies of a module (i.e., the number of packages that depend on it) to the total number of dependencies (i.e., the sum of incoming and outgoing dependencies).

Small values near zero indicate low *Instability*. With no outgoing but some incoming dependencies the Instability is zero which is denoted as maximally stable. Such code units are more rigid and difficult to change without impacting other parts of the system. If they are changed less because of that, they are considered stable.

Conversely, high values approaching one indicate high *Instability*. With some outgoing dependencies but no incoming ones the *Instability* is denoted as maximally unstable. Such code units are easier to change without affecting other modules, making them more flexible and less prone to cascading changes throughout the system. If they are changed more often because of that, they are considered unstable.

Since Java Packages are organized hierarchically, *Instability* can be calculated for every package in isolation or by including all of its sub-packages.

Table 3a

- Show the top 20 Java Packages with the lowest *Instability*
- Set the property "instability" on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	instability	instabilityTypes	instabilityInterfaces	instabilityPackages	instabilityArtifacts
0	axon-messaging-4.10.0	org.axonframework.messaging	messaging	0.013225	0.087940	0.180723	0.089552	0.0
1	axon-messaging-4.10.0	org.axonframework.common.transaction	transaction	0.016043	0.043011	0.000000	0.030303	0.0
2	axon-messaging-4.10.0	org.axonframework.common	common	0.021576	0.039267	0.000000	0.011494	0.0
3	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling	scheduling	0.074074	0.111111	0.000000	0.181818	0.0
4	axon-messaging-4.10.0	org.axonframework.lifecycle	lifecycle	0.090090	0.184211	0.000000	0.125000	0.0
5	axon-messaging-4.10.0	org.axonframework.monitoring	monitoring	0.095455	0.145833	0.333333	0.214286	0.0
6	axon-messaging-4.10.0	org.axonframework.serialization	serialization	0.096122	0.208145	0.304348	0.183673	0.0
7	axon-messaging-4.10.0	org.axonframework.common.annotation	annotation	0.120000	0.120000	0.000000	0.166667	0.0
8	axon-messaging-4.10.0	org.axonframework.common.stream	stream	0.131579	0.150000	0.000000	0.111111	0.0
9	axon-messaging-4.10.0	org.axonframework.tracing	tracing	0.161162	0.198529	0.480000	0.272727	0.0
10	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	0.210250	0.327198	0.500000	0.235294	0.0
11	axon-messaging-4.10.0	org.axonframework.messaging.annotation	annotation	0.218116	0.303167	0.406250	0.212121	0.0
12	axon-messaging-4.10.0	org.axonframework.common.jpa	jpa	0.240000	0.217391	1.000000	0.250000	0.0
13	axon-messaging-4.10.0	org.axonframework.common.legacyjpa	legacyjpa	0.260870	0.238095	1.000000	0.272727	0.0
14	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	0.266384	0.350711	0.600000	0.300000	0.0
15	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot	springboot	0.280488	0.463415	0.000000	0.333333	1.0
16	axon-messaging-4.10.0	org.axonframework.messaging.correlation	correlation	0.304348	0.200000	0.400000	0.285714	0.0
17	axon-messaging-4.10.0	org.axonframework.serialization.upcasting	upcasting	0.312500	0.083333	0.000000	0.333333	0.0
18	axon-messaging-4.10.0	org.axonframework.messaging.unitofwork	unitofwork	0.321990	0.194175	0.583333	0.119048	0.0
19	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	0.332248	0.370968	0.500000	0.357143	0.0

Table 3b

- Show the top 20 Java Packages including their sub-packages with the lowest *Instability*
- Set the property "instabilityIncludingSubpackages" on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	instability	instabilityTypes	instabilityInterfaces	instabilityPackages	instabilityArt
0	axon-messaging-4.10.0	org.axonframework.common	common	0.003418	0.012195	0.000000	0.023810	
1	axon-messaging-4.10.0	org.axonframework.messaging	messaging	0.020748	0.067669	0.402878	0.114286	
2	axon-messaging-4.10.0	org.axonframework.serialization	serialization	0.032258	0.154839	0.190476	0.186047	
3	axon-messaging-4.10.0	org.axonframework.lifecycle	lifecycle	0.040404	0.068966	0.000000	0.090909	
4	axon-messaging-4.10.0	org.axonframework.monitoring	monitoring	0.040609	0.052632	0.454545	0.166667	
5	axon-messaging-4.10.0	org.axonframework.tracing	tracing	0.055184	0.141414	0.187500	0.275862	
6	axon-messaging-4.10.0	org.axonframework.messaging.annotation	annotation	0.073359	0.155039	0.424242	0.193548	
7	axon-messaging-4.10.0	org.axonframework.common.annotation	annotation	0.086957	0.086957	0.000000	0.100000	
8	axon-messaging-4.10.0	org.axonframework.common.lock	lock	0.107143	0.142857	0.000000	0.142857	
9	axon-messaging-4.10.0	org.axonframework.messaging.unitofwork	unitofwork	0.112000	0.100000	0.375000	0.100000	
10	axon-messaging-4.10.0	org.axonframework.messaging.responsetypes	responsetypes	0.126214	0.333333	0.000000	0.500000	
11	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	0.137712	0.379928	0.451327	0.377358	
12	axon-messaging-4.10.0	org.axonframework.common.jdbc	jdbc	0.150943	0.212121	0.000000	0.266667	
13	axon-messaging-4.10.0	org.axonframework.common.jpa	jpa	0.157895	0.117647	0.000000	0.200000	
14	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	0.161850	0.489051	0.512195	0.448276	
15	axon-messaging-4.10.0	org.axonframework.common.property	property	0.166667	0.250000	0.000000	0.200000	
16	axon-messaging-4.10.0	org.axonframework.common.legacyjpa	legacyjpa	0.176471	0.133333	0.000000	0.222222	
17	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	0.183962	0.272727	0.466667	0.333333	
18	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.snapshotting	snapshotting	0.187500	0.250000	0.500000	0.333333	
19	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event.util	util	0.200000	0.200000	0.000000	0.250000	

Abstractness

$$Abstractness = \frac{abstract\ classes\ in\ category}{total\ number\ of\ classes\ in\ category}$$

Package *Abstractness* is expressed as the ratio of the number of abstract classes and interfaces to the total number of classes of a package.

Zero *Abstractness* means that there are no abstract types or interfaces in the package. On the other hand, a value of one means that there are only abstract types.

Since Java Packages are organized hierarchically, *Abstractness* can be calculated for every package in isolation or by including all of its sub-packages.

Table 4a

- Show the top 30 packages with the lowest *Abstractness*
- Set the property "abstractness" on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes
0	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.autoconfig	autoconfig	0.0	0	29
1	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot	springboot	0.0	0	25
2	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.leg...	legacyjpa	0.0	0	10
3	axon-messaging-4.10.0	org.axonframework.commandhandling.distributed....	commandfilter	0.0	0	7
4	axon-messaging-4.10.0	org.axonframework.deadline.dbscheduler	dbscheduler	0.0	0	7
5	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling.dbs...	dbscheduler	0.0	0	7
6	axon-messaging-4.10.0	org.axonframework.serialization.json	json	0.0	0	7
7	axon-messaging-4.10.0	org.axonframework.serialization.xml	xml	0.0	0	7
8	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.query.s...	subscription	0.0	0	6
9	axon-messaging-4.10.0	org.axonframework.tracing.attributes	attributes	0.0	0	6
10	axon-messaging-4.10.0	org.axonframework.eventhandling.deadletter	deadletter	0.0	0	5
11	axon-messaging-4.10.0	org.axonframework.serialization.converters	converters	0.0	0	5
12	axon-tracing-opentelemetry-4.10.0	org.axonframework.tracing.opentelemetry	opentelemetry	0.0	0	5
13	axon-test-4.10.0	org.axonframework.test.server	server	0.0	0	4
14	axon-messaging-4.10.0	org.axonframework.commandhandling.callbacks	callbacks	0.0	0	4
15	axon-messaging-4.10.0	org.axonframework.deadline.quartz	quartz	0.0	0	4
16	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling.java	java	0.0	0	4
17	axon-messaging-4.10.0	org.axonframework.eventhandling.tokenstore.jpa	jpa	0.0	0	4
18	axon-modelling-4.10.0	org.axonframework.modelling.saga.repository.le...	legacyjpa	0.0	0	3
19	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.processor	processor	0.0	0	3
20	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event.util	util	0.0	0	3
21	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling.job...	jobrunr	0.0	0	3
22	axon-messaging-4.10.0	org.axonframework.util	util	0.0	0	3
23	axon-modelling-4.10.0	org.axonframework.modelling.command.legacyjpa	legacyjpa	0.0	0	2
24	axon-modelling-4.10.0	org.axonframework.modelling.saga.repository.in...	inmemory	0.0	0	2
25	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.heartbe...	checker	0.0	0	2
26	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.actuator.axonserver	axonserver	0.0	0	2
27	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.autoconfig.legacyjpa	legacyjpa	0.0	0	2
28	axon-messaging-4.10.0	org.axonframework.eventhandling.tokenstore.inm...	inmemory	0.0	0	2
29	axon-messaging-4.10.0	org.axonframework.eventhandling.tokenstore.leg...	legacyjpa	0.0	0	2

Table 4b

- Show the top 30 packages with the highest *Abstractness* and number of Java Types

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes
137	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.jdb...	statements	1.000000	15	15
138	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.actuator	actuator	1.000000	1	1
136	axon-messaging-4.10.0	org.axonframework.serialization.upcasting	upcasting	0.833333	5	6
133	axon-messaging-4.10.0	org.axonframework.common.annotation	annotation	0.666667	2	3
134	axon-messaging-4.10.0	org.axonframework.common.stream	stream	0.666667	2	3
135	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling	scheduling	0.666667	2	3
132	axon-messaging-4.10.0	org.axonframework.common	common	0.642857	18	28
129	axon-messaging-4.10.0	org.axonframework.messaging	messaging	0.600000	21	35
130	axon-messaging-4.10.0	org.axonframework.lifecycle	lifecycle	0.600000	6	10
131	axon-messaging-4.10.0	org.axonframework.eventhandling.gateway	gateway	0.600000	3	5
128	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.util	util	0.555556	5	9
125	axon-messaging-4.10.0	org.axonframework.serialization.upcasting.event	event	0.500000	6	12
126	axon-modelling-4.10.0	org.axonframework.modelling.saga.metamodel	metamodel	0.500000	2	4
127	axon-messaging-4.10.0	org.axonframework.common.transaction	transaction	0.500000	2	4
123	axon-messaging-4.10.0	org.axonframework.common.jdbc	jdbc	0.444444	8	18
124	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.conflictresolu...	conflictresolution	0.444444	4	9
122	axon-configuration-4.10.0	org.axonframework.config	config	0.439024	18	41
121	axon-modelling-4.10.0	org.axonframework.modelling.command	command	0.425926	23	54
120	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	0.410000	41	100
115	axon-test-4.10.0	org.axonframework.test.utils	utils	0.400000	2	5
116	axon-test-4.10.0	org.axonframework.test.eventscheduler	eventscheduler	0.400000	2	5
117	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.heartbeat	heartbeat	0.400000	2	5
118	axon-messaging-4.10.0	org.axonframework.deadline.annotation	annotation	0.400000	2	5
119	axon-messaging-4.10.0	org.axonframework.queryhandling.registration	registration	0.400000	2	5
114	axon-modelling-4.10.0	org.axonframework.modelling.saga	saga	0.393939	13	33
111	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	0.375000	12	32
112	axon-messaging-4.10.0	org.axonframework.messaging.interceptors	interceptors	0.375000	3	8
113	axon-messaging-4.10.0	org.axonframework.messaging.responsetypes	responsetypes	0.375000	3	8
110	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	0.368421	7	19
109	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore	eventstore	0.354839	11	31

Table 4c

- Show the top 30 packages including their sub-packages with the highest package depth and lowest *Abstractness*
- Set the property "abstractnessIncludingSubpackages" on Package nodes.

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes	maxSubpackageDepth
0	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.autoconfig	autoconfig	0.0	0	31	1
1	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.heartbe...	connection	0.0	0	2	1
2	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.leg...	legacyjpa	0.0	0	10	0
3	axon-messaging-4.10.0	org.axonframework.commandhandling.distributed....	commandfilter	0.0	0	7	0
4	axon-messaging-4.10.0	org.axonframework.deadline.dbscheduler	dbscheduler	0.0	0	7	0
5	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling.dbs...	dbscheduler	0.0	0	7	0
6	axon-messaging-4.10.0	org.axonframework.serialization.json	json	0.0	0	7	0
7	axon-messaging-4.10.0	org.axonframework.serialization.xml	xml	0.0	0	7	0
8	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.query.s...	subscription	0.0	0	6	0
9	axon-messaging-4.10.0	org.axonframework.tracing.attributes	attributes	0.0	0	6	0
10	axon-messaging-4.10.0	org.axonframework.serialization.converters	converters	0.0	0	5	0
11	axon-tracing-opentelemetry-4.10.0	org.axonframework.tracing.opentelemetry	opentelemetry	0.0	0	5	0
12	axon-test-4.10.0	org.axonframework.test.server	server	0.0	0	4	0
13	axon-messaging-4.10.0	org.axonframework.commandhandling.callbacks	callbacks	0.0	0	4	0
14	axon-messaging-4.10.0	org.axonframework.deadline.quartz	quartz	0.0	0	4	0
15	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling.java	java	0.0	0	4	0
16	axon-messaging-4.10.0	org.axonframework.eventhandling.tokenstore.jpa	jpa	0.0	0	4	0
17	axon-modelling-4.10.0	org.axonframework.modelling.saga.repository.le...	legacyjpa	0.0	0	3	0
18	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.processor	processor	0.0	0	3	0
19	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event.util	util	0.0	0	3	0
20	axon-messaging-4.10.0	org.axonframework.eventhandling.scheduling.job...	jobrunr	0.0	0	3	0
21	axon-messaging-4.10.0	org.axonframework.util	util	0.0	0	3	0
22	axon-modelling-4.10.0	org.axonframework.modelling.command.legacyjpa	legacyjpa	0.0	0	2	0
23	axon-modelling-4.10.0	org.axonframework.modelling.saga.repository.in...	inmemory	0.0	0	2	0
24	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.heartbe...	checker	0.0	0	2	0
25	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.actuator.axonserver	axonserver	0.0	0	2	0
26	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.autoconfig.legacyjpa	legacyjpa	0.0	0	2	0
27	axon-messaging-4.10.0	org.axonframework.eventhandling.tokenstore.inm...	inmemory	0.0	0	2	0
28	axon-messaging-4.10.0	org.axonframework.eventhandling.tokenstore.leg...	legacyjpa	0.0	0	2	0
29	axon-messaging-4.10.0	org.axonframework.messaging.interceptors.legac...	legacyvalidation	0.0	0	2	0

Table 4d

- Show the top 30 packages including their sub-packages with the highest package depth and highest *Abstractness*

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes	maxSubpackageDepth
116	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.jdb...	statements	1.000000	15	15	0
114	axon-messaging-4.10.0	org.axonframework.common.annotation	annotation	0.666667	2	3	0
115	axon-messaging-4.10.0	org.axonframework.common.stream	stream	0.666667	2	3	0
113	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	0.620690	18	29	1
112	axon-messaging-4.10.0	org.axonframework.serialization.upcasting	upcasting	0.611111	11	18	1
110	axon-messaging-4.10.0	org.axonframework.lifecycle	lifecycle	0.600000	6	10	0
111	axon-messaging-4.10.0	org.axonframework.eventhandling.gateway	gateway	0.600000	3	5	0
107	axon-messaging-4.10.0	org.axonframework.serialization.upcasting.event	event	0.500000	6	12	0
108	axon-modelling-4.10.0	org.axonframework.modelling.saga.metamodel	metamodel	0.500000	2	4	0
109	axon-messaging-4.10.0	org.axonframework.common.transaction	transaction	0.500000	2	4	0
106	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.util	util	0.454545	5	11	1
104	axon-messaging-4.10.0	org.axonframework.common.jdbc	jdbc	0.444444	8	18	0
105	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.conflictresolu...	conflictresolution	0.444444	4	9	0
103	axon-configuration-4.10.0	org.axonframework.config	config	0.439024	18	41	0
102	axon-messaging-4.10.0	org.axonframework.common	common	0.425743	43	101	1
98	axon-test-4.10.0	org.axonframework.test.utils	utils	0.400000	2	5	0
99	axon-test-4.10.0	org.axonframework.test.eventscheduler	eventscheduler	0.400000	2	5	0
100	axon-messaging-4.10.0	org.axonframework.deadline.annotation	annotation	0.400000	2	5	0
101	axon-messaging-4.10.0	org.axonframework.queryhandling.registration	registration	0.400000	2	5	0
97	axon-modelling-4.10.0	org.axonframework.modelling.command	command	0.390244	32	82	1
96	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore	eventstore	0.379747	30	79	2
94	axon-messaging-4.10.0	org.axonframework.messaging	messaging	0.375000	54	144	2
95	axon-messaging-4.10.0	org.axonframework.messaging.responsetypes	responsetypes	0.375000	3	8	0
93	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	0.368421	7	19	0
92	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing	eventsourcing	0.353383	47	133	3
91	axon-modelling-4.10.0	org.axonframework.modelling.command.inspection	inspection	0.346154	9	26	0
86	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.actuator	actuator	0.333333	1	3	1
87	axon-test-4.10.0	org.axonframework.test.saga	saga	0.333333	7	21	0
88	axon-messaging-4.10.0	org.axonframework.common.property	property	0.333333	3	9	0
89	axon-messaging-4.10.0	org.axonframework.monitoring	monitoring	0.333333	2	6	0

Distance from the main sequence

The *main sequence* is a imaginary line that represents a good compromise between *Abstractness* and *Instability*. A high distance to this line may indicate problems. For example is very *stable* (rigid) code with low abstractness hard to change.

Read more details on that in OO Design Quality Metrics and Calculate metrics.

Table 5a

- Show the top 30 packages with the highest distance from the "main sequence"

	artifactName	fullQualifiedName	name	distance	abstractness	instability	elementsCount
0	axon-messaging-4.10.0	org.axonframework.serialization.converters	converters	NaN	0.0	NaN	5
1	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.heartbe...	source	NaN	0.0	NaN	1
2	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.actuator	actuator	NaN	1.0	NaN	1
3	axon-messaging-4.10.0	org.axonframework.common.io	io	NaN	0.0	NaN	1
4	axon-messaging-4.10.0	org.axonframework.eventhandling.interceptors	interceptors	NaN	0.0	NaN	1
5	axon-test-4.10.0	org	org	NaN	0.0	NaN	0
6	axon-test-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
7	axon-modelling-4.10.0	org	org	NaN	0.0	NaN	0
8	axon-modelling-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
9	axon-modelling-4.10.0	org.axonframework.modelling	modelling	NaN	0.0	NaN	0
10	axon-configuration-4.10.0	org	org	NaN	0.0	NaN	0
11	axon-configuration-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
12	axon-server-connector-4.10.0	org	org	NaN	0.0	NaN	0
13	axon-server-connector-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
14	axon-server-connector-4.10.0	org.axonframework.axonserver	axonserver	NaN	0.0	NaN	0
15	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.heartbe...	connection	NaN	0.0	NaN	0
16	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event	event	NaN	0.0	NaN	0
17	axon-spring-boot-autoconfigure-4.10.0	org	org	NaN	0.0	NaN	0
18	axon-spring-boot-autoconfigure-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
19	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.service	service	NaN	0.0	NaN	0
20	axon-disruptor-4.10.0	org	org	NaN	0.0	NaN	0
21	axon-disruptor-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
22	axon-disruptor-4.10.0	org.axonframework.disruptor	disruptor	NaN	0.0	NaN	0
23	axon-messaging-4.10.0	org	org	NaN	0.0	NaN	0
24	axon-messaging-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
25	axon-eventsourcing-4.10.0	org	org	NaN	0.0	NaN	0
26	axon-eventsourcing-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
27	axon-tracing-opentelemetry-4.10.0	org	org	NaN	0.0	NaN	0
28	axon-tracing-opentelemetry-4.10.0	org.axonframework	axonframework	NaN	0.0	NaN	0
29	axon-tracing-opentelemetry-4.10.0	org.axonframework.tracing	tracing	NaN	0.0	NaN	0

Table 5b

- Show the top 30 packages including their sub-packages with the highest distance from the "main sequence"

	artifactName	fullQualifiedName	name	distance	abstractness	instability	elementsCount
0	axon-server-connector-4.10.0	org.axonframework.axonserver.connector.event.util	util	0.800000	0.000000	0.200000	3
1	axon-messaging-4.10.0	org.axonframework.tracing	tracing	0.744816	0.200000	0.055184	25
2	axon-messaging-4.10.0	org.axonframework.common.lock	lock	0.711039	0.181818	0.107143	11
3	axon-messaging-4.10.0	org.axonframework.serialization	serialization	0.671967	0.295775	0.032258	71
4	axon-test-4.10.0	org.axonframework.test.server	server	0.666667	0.000000	0.333333	4
5	axon-messaging-4.10.0	org.axonframework.common.digest	digest	0.666667	0.000000	0.333333	1
6	axon-messaging-4.10.0	org.axonframework.messaging.annotation	annotation	0.648863	0.277778	0.073359	54
7	axon-messaging-4.10.0	org.axonframework.monitoring	monitoring	0.626058	0.333333	0.040609	6
8	axon-test-4.10.0	org.axonframework.test.matchers	matchers	0.606707	0.125000	0.268293	24
9	axon-messaging-4.10.0	org.axonframework.messaging	messaging	0.604252	0.375000	0.020748	144
10	axon-messaging-4.10.0	org.axonframework.messaging.unitofwork	unitofwork	0.602286	0.285714	0.112000	14
11	axon-messaging-4.10.0	org.axonframework.common.jpa	jpa	0.592105	0.250000	0.157895	4
12	axon-messaging-4.10.0	org.axonframework.eventhandling	eventhandling	0.584510	0.277778	0.137712	234
13	axon-messaging-4.10.0	org.axonframework.common.legacyjpa	legacyjpa	0.573529	0.250000	0.176471	4
14	axon-messaging-4.10.0	org.axonframework.common	common	0.570840	0.425743	0.003418	101
15	axon-messaging-4.10.0	org.axonframework.commandhandling	commandhandling	0.556597	0.281553	0.161850	103
16	axon-messaging-4.10.0	org.axonframework.messaging.correlation	correlation	0.533784	0.250000	0.216216	4
17	axon-messaging-4.10.0	org.axonframework.common.property	property	0.500000	0.333333	0.166667	9
18	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.util.legacyjpa	legacyjpa	0.500000	0.000000	0.500000	1
19	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.springboot.util.jpa	jpa	0.500000	0.000000	0.500000	1
20	axon-messaging-4.10.0	org.axonframework.messaging.responsetypes	responsetypes	0.498786	0.375000	0.126214	8
21	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.eventstore.jdb...	statements	0.480769	1.000000	0.480769	15
22	axon-eventsourcing-4.10.0	org.axonframework.eventsourcing.snapshotting	snapshotting	0.479167	0.333333	0.187500	3
23	axon-messaging-4.10.0	org.axonframework.serialization.xml	xml	0.466667	0.000000	0.533333	7
24	axon-messaging-4.10.0	org.axonframework.util	util	0.454545	0.000000	0.545455	3
25	axon-messaging-4.10.0	org.axonframework.messaging.deadletter	deadletter	0.447617	0.368421	0.183962	19
26	axon-messaging-4.10.0	org.axonframework.commandhandling.callbacks	callbacks	0.409091	0.000000	0.590909	4
27	axon-messaging-4.10.0	org.axonframework.common.jdbc	jdbc	0.404612	0.444444	0.150943	18
28	axon-modelling-4.10.0	org.axonframework.modelling.saga.repository.in...	inmemory	0.400000	0.000000	0.600000	2
29	axon-spring-boot-autoconfigure-4.10.0	org.axonframework.actuator.axonserver	axonserver	0.400000	0.000000	0.600000	2

Abstractness vs. *Instability* Plot with "Main Sequence" line as reference

- Plot *Abstractness* vs. *Instability* of all packages
- Draw the "main sequence" as dashed green diagonal line
- Scale the packages by the number of types they contain
- Color the packages by their distance to the "main sequence" (blue=near, red=far)
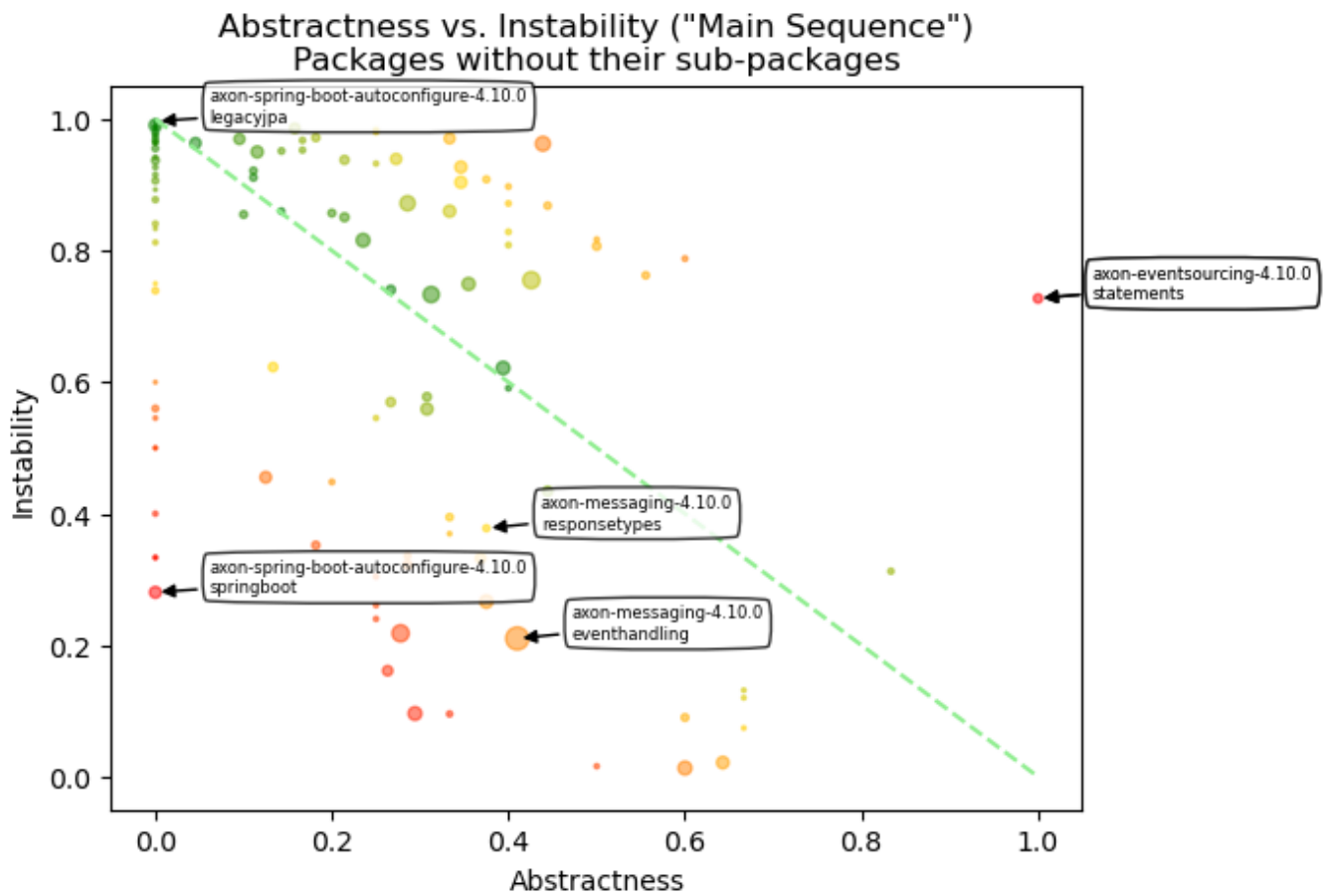
Figure 5a - Packages without their sub-packages

Figure 5b - Packages including their sub-packages

Abstractness vs. Instability ("Main Sequence")
Packages including their sub-packages