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-4.9.3	org.axonframework.messaging	messaging	8706	25535	329	
1	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	5363	23731	301	
2	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	1641	5354	126	
3	axon-messaging-4.9.3	org.axonframework.serialization	serialization	1233	5088	138	
4	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	1057	4012	151	
5	axon-messaging-4.9.3	org.axonframework.common	common	926	2126	338	
6	axon-messaging-4.9.3	org.axonframework.tracing	tracing	516	2293	93	
7	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	314	988	76	
8	axon-modelling-4.9.3	org.axonframework.modelling.command	command	269	927	79	
9	axon-modelling-4.9.3	org.axonframework.modelling.saga	saga	257	1132	60	
10	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	unitofwork	256	1064	82	
11	axon-messaging-4.9.3	org.axonframework.deadline	deadline	238	1229	42	
12	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	218	1205	26	
13	axon-messaging-4.9.3	org.axonframework.queryhandling	queryhandling	214	858	55	
14	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	197	1140	35	
15	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	188	500	39	
16	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	169	689	60	
17	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	eventsourcing	141	568	44	
18	axon-configuration-4.9.3	org.axonframework.config	config	118	1224	35	
19	axon-messaging-4.9.3	org.axonframework.commandhandling.gateway	gateway	97	341	33	

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-4.9.3	org.axonframework.messaging	messaging	7690	24528	328	
1	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	3109	12117	142	
2	axon-messaging-4.9.3	org.axonframework.common	common	1269	3565	360	
3	axon-messaging-4.9.3	org.axonframework.serialization	serialization	1069	4438	92	
4	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	938	3665	106	
5	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	784	3114	57	
6	axon-messaging-4.9.3	org.axonframework.tracing	tracing	466	2085	72	
7	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	308	974	73	
8	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	unitofwork	219	847	71	
9	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	178	470	34	
10	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	165	1008	20	
11	axon-modelling-4.9.3	org.axonframework.modelling.command	command	159	526	37	
12	axon-messaging-4.9.3	org.axonframework.deadline	deadline	114	727	19	
13	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	eventsourcing	101	385	14	
14	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	85	230	23	
15	axon-modelling-4.9.3	org.axonframework.modelling.saga	saga	74	225	18	
16	axon-messaging-4.9.3	org.axonframework.lifecycle	lifecycle	65	161	19	
17	axon-messaging-4.9.3	org.axonframework.messaging.responsetypes	responsetypes	61	280	14	
18	axon-messaging-4.9.3	org.axonframework.queryhandling	queryhandling	53	178	8	
19	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore	tokenstore	47	186	21	

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-4.9.3	org.axonframework.config	config	9863	37635	241
1	axon-test-4.9.3	org.axonframework.test.aggregate	aggregate	2210	7943	92
2	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	1563	6457	160
3	axon-disruptor-4.9.3	org.axonframework.disruptor.commandhandling	commandhandling	1453	5180	84
4	axon-test-4.9.3	org.axonframework.test.saga	saga	1419	4096	81
5	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	1340	6712	51
6	axon-messaging-4.9.3	org.axonframework.queryhandling	queryhandling	1141	5254	86
7	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	eventsourcing	1009	3348	95
8	axon-messaging-4.9.3	org.axonframework.eventhandling.pooled	pooled	885	4117	56
9	axon-modelling-4.9.3	org.axonframework.modelling.command	command	842	3161	94
10	axon-modelling-4.9.3	org.axonframework.modelling.command.inspection	inspection	781	3026	73
11	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed	distributed	738	2227	74
12	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	691	1832	74
13	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	613	1981	65
14	axon-messaging-4.9.3	org.axonframework.eventhandling.deadletter.jdbc	jdbc	560	3512	49
15	axon-messaging-4.9.3	org.axonframework.deadline.dbscheduler	dbscheduler	488	1845	40
16	axon-messaging-4.9.3	org.axonframework.deadline.quartz	quartz	453	1492	40
17	axon-messaging-4.9.3	org.axonframework.commandhandling.gateway	gateway	443	1199	56
18	axon-modelling-4.9.3	org.axonframework.modelling.saga	saga	432	1464	62
19	axon-messaging-4.9.3	org.axonframework.deadline.jobrunr	jobrunr	419	1315	37

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-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	585	2115	106
1	axon-configuration-4.9.3	org.axonframework.config	config	539	1689	201
2	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	eventsourcing	380	1319	95
3	axon-test-4.9.3	org.axonframework.test	test	273	791	99
4	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	245	914	58
5	axon-modelling-4.9.3	org.axonframework.modelling.command	command	230	759	63
6	axon-messaging-4.9.3	org.axonframework.eventhandling.deadletter	deadletter	207	993	57
7	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	195	482	67
8	axon-messaging-4.9.3	org.axonframework.deadline	deadline	190	608	48
9	axon-messaging-4.9.3	org.axonframework.messaging	messaging	183	480	27
10	axon-messaging-4.9.3	org.axonframework.queryhandling	queryhandling	175	607	51
11	axon-modelling-4.9.3	org.axonframework.modelling.saga	saga	155	474	58
12	axon-test-4.9.3	org.axonframework.test.aggregate	aggregate	149	548	74
13	axon-disruptor-4.9.3	org.axonframework.disruptor.commandhandling	commandhandling	130	436	62
14	axon-modelling-4.9.3	org.axonframework.modelling.command.inspection	inspection	119	416	51
15	axon-test-4.9.3	org.axonframework.test.saga	saga	111	387	60
16	axon-messaging-4.9.3	org.axonframework.eventhandling.pooled	pooled	105	453	35
17	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository	repository	103	441	34
18	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed	distributed	93	248	48
19	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling	scheduling	88	291	22

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-4.9.3	org.axonframework.messaging	messaging	0.015047	0.096154	0.185185	0.101695	0.0
1	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	0.018750	0.050000	0.000000	0.034483	0.0
2	axon-messaging-4.9.3	org.axonframework.common	common	0.024236	0.042493	0.000000	0.012658	0.0
3	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling	scheduling	0.090909	0.142857	0.000000	0.222222	0.0
4	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	0.100478	0.152174	0.333333	0.230769	0.0
5	axon-messaging-4.9.3	org.axonframework.common.annotation	annotation	0.120000	0.120000	0.000000	0.166667	0.0
6	axon-messaging-4.9.3	org.axonframework.lifecycle	lifecycle	0.123457	0.233333	0.000000	0.176471	0.0
7	axon-messaging-4.9.3	org.axonframework.serialization	serialization	0.124911	0.250000	0.318182	0.214286	0.0
8	axon-messaging-4.9.3	org.axonframework.common.stream	stream	0.147059	0.166667	0.000000	0.125000	0.0
9	axon-messaging-4.9.3	org.axonframework.tracing	tracing	0.191223	0.225000	0.480000	0.333333	0.0
10	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	0.221649	0.307339	0.406250	0.218750	0.0
11	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	0.225671	0.347072	0.500000	0.258065	0.0
12	axon-messaging-4.9.3	org.axonframework.common.jpa	jpa	0.272727	0.250000	1.000000	0.300000	0.0
13	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	0.296312	0.370000	0.612245	0.333333	0.0
14	axon-messaging-4.9.3	org.axonframework.common.legacyjpa	legacyjpa	0.300000	0.277778	1.000000	0.333333	0.0
15	axon-messaging-4.9.3	org.axonframework.serialization.upcasting	upcasting	0.312500	0.083333	0.000000	0.333333	0.0
16	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	unitofwork	0.324538	0.196078	0.583333	0.121951	0.0
17	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.333333	0.333333	0.000000	0.333333	0.0
18	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	0.341137	0.396552	0.500000	0.454545	0.0
19	axon-messaging-4.9.3	org.axonframework.common.lock	lock	0.352113	0.363636	0.500000	0.222222	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	instabilityArtifa
0	axon-messaging-4.9.3	org.axonframework.common	common	0.003925	0.013699	0.000000	0.027778	(
1	axon-messaging-4.9.3	org.axonframework.messaging	messaging	0.023244	0.076056	0.400000	0.133333	(
2	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	0.043011	0.055556	0.454545	0.181818	(
3	axon-messaging-4.9.3	org.axonframework.serialization	serialization	0.044683	0.206897	0.200000	0.222222	(
4	axon-messaging-4.9.3	org.axonframework.lifecycle	lifecycle	0.057971	0.095238	0.000000	0.133333	(
5	axon-messaging-4.9.3	org.axonframework.tracing	tracing	0.066132	0.162791	0.187500	0.333333	(
6	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	0.074951	0.158730	0.424242	0.200000	(
7	axon-messaging-4.9.3	org.axonframework.common.annotation	annotation	0.086957	0.086957	0.000000	0.100000	(
8	axon-messaging-4.9.3	org.axonframework.common.lock	lock	0.107143	0.142857	0.000000	0.142857	(
9	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	unitofwork	0.113360	0.101266	0.375000	0.102564	(
10	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	0.158365	0.427419	0.463636	0.425532	(
11	axon-messaging-4.9.3	org.axonframework.common.property	property	0.166667	0.250000	0.000000	0.200000	(
12	axon-messaging-4.9.3	org.axonframework.messaging.responsetypes	responsetypes	0.175676	0.416667	0.000000	0.625000	(
13	axon-messaging-4.9.3	org.axonframework.common.jdbc	jdbc	0.177778	0.259259	0.000000	0.333333	(
14	axon-messaging-4.9.3	org.axonframework.common.jpa	jpa	0.187500	0.142857	0.000000	0.250000	(
15	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	0.191176	0.310345	0.466667	0.444444	(
16	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	0.199183	0.540323	0.512821	0.500000	(
17	axon-messaging-4.9.3	org.axonframework.common.legacyjpa	legacyjpa	0.214286	0.166667	0.000000	0.285714	(
18	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.snapshotting	snapshotting	0.230769	0.307692	0.500000	0.375000	(
19	axon-messaging-4.9.3	org.axonframework.messaging.correlation	correlation	0.266667	0.222222	0.500000	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-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.leg...	legacyjpa	0.0	0	10
1	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed....	commandfilter	0.0	0	7
2	axon-messaging-4.9.3	org.axonframework.deadline.dbscheduler	dbscheduler	0.0	0	7
3	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.dbs...	dbscheduler	0.0	0	7
4	axon-messaging-4.9.3	org.axonframework.serialization.json	json	0.0	0	7
5	axon-messaging-4.9.3	org.axonframework.serialization.xml	xml	0.0	0	7
6	axon-messaging-4.9.3	org.axonframework.tracing.attributes	attributes	0.0	0	6
7	axon-messaging-4.9.3	org.axonframework.eventhandling.deadletter	deadletter	0.0	0	5
8	axon-messaging-4.9.3	org.axonframework.serialization.converters	converters	0.0	0	5
9	axon-test-4.9.3	org.axonframework.test.server	server	0.0	0	4
10	axon-messaging-4.9.3	org.axonframework.commandhandling.callbacks	callbacks	0.0	0	4
11	axon-messaging-4.9.3	org.axonframework.deadline.quartz	quartz	0.0	0	4
12	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.java	java	0.0	0	4
13	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.jpa	jpa	0.0	0	4
14	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.le...	legacyjpa	0.0	0	3
15	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.job...	jobrunr	0.0	0	3
16	axon-messaging-4.9.3	org.axonframework.util	util	0.0	0	3
17	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.inm...	inmemory	0.0	0	2
18	axon-modelling-4.9.3	org.axonframework.modelling.command.legacyjpa	legacyjpa	0.0	0	2
19	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.in...	inmemory	0.0	0	2
20	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.inm...	inmemory	0.0	0	2
21	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.leg...	legacyjpa	0.0	0	2
22	axon-messaging-4.9.3	org.axonframework.messaging.interceptors.legac...	legacyvalidation	0.0	0	2
23	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.0	0	1
24	axon-messaging-4.9.3	org.axonframework.common.io	io	0.0	0	1
25	axon-messaging-4.9.3	org.axonframework.eventhandling.interceptors	interceptors	0.0	0	1
26	axon-eventsourcing-4.9.3	org	org	0.0	0	0
27	axon-eventsourcing-4.9.3	org.axonframework	axonframework	0.0	0	0
28	axon-test-4.9.3	org	org	0.0	0	0
29	axon-test-4.9.3	org.axonframework	axonframework	0.0	0	0

Table 4b

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

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes
106	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdb...	statements	1.000000	15	15
105	axon-messaging-4.9.3	org.axonframework.serialization.upcasting	upcasting	0.833333	5	6
102	axon-messaging-4.9.3	org.axonframework.common.annotation	annotation	0.666667	2	3
103	axon-messaging-4.9.3	org.axonframework.common.stream	stream	0.666667	2	3
104	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling	scheduling	0.666667	2	3
101	axon-messaging-4.9.3	org.axonframework.common	common	0.642857	18	28
98	axon-messaging-4.9.3	org.axonframework.messaging	messaging	0.600000	21	35
99	axon-messaging-4.9.3	org.axonframework.lifecycle	lifecycle	0.600000	6	10
100	axon-messaging-4.9.3	org.axonframework.eventhandling.gateway	gateway	0.600000	3	5
95	axon-messaging-4.9.3	org.axonframework.serialization.upcasting.event	event	0.500000	6	12
96	axon-modelling-4.9.3	org.axonframework.modelling.saga.metamodel	metamodel	0.500000	2	4
97	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	0.500000	2	4
93	axon-messaging-4.9.3	org.axonframework.common.jdbc	jdbc	0.444444	8	18
94	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.conflictresolu...	conflictresolution	0.444444	4	9
92	axon-modelling-4.9.3	org.axonframework.modelling.command	command	0.425926	23	54
91	axon-configuration-4.9.3	org.axonframework.config	config	0.425000	17	40
90	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	0.410000	41	100
86	axon-test-4.9.3	org.axonframework.test.utils	utils	0.400000	2	5
87	axon-test-4.9.3	org.axonframework.test.eventscheduler	eventscheduler	0.400000	2	5
88	axon-messaging-4.9.3	org.axonframework.deadline.annotation	annotation	0.400000	2	5
89	axon-messaging-4.9.3	org.axonframework.queryhandling.registration	registration	0.400000	2	5
85	axon-modelling-4.9.3	org.axonframework.modelling.saga	saga	0.393939	13	33
82	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	0.375000	12	32
83	axon-messaging-4.9.3	org.axonframework.messaging.interceptors	interceptors	0.375000	3	8
84	axon-messaging-4.9.3	org.axonframework.messaging.responsetypes	responsetypes	0.375000	3	8
81	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	0.368421	7	19
80	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	0.354839	11	31
78	axon-modelling-4.9.3	org.axonframework.modelling.command.inspection	inspection	0.346154	9	26
79	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed	distributed	0.346154	9	26
74	axon-test-4.9.3	org.axonframework.test.saga	saga	0.333333	7	21

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-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.leg...	legacyjpa	0.000000	0	10	0
1	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed....	commandfilter	0.000000	0	7	0
2	axon-messaging-4.9.3	org.axonframework.deadline.dbscheduler	dbscheduler	0.000000	0	7	0
3	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.dbs...	dbscheduler	0.000000	0	7	0
4	axon-messaging-4.9.3	org.axonframework.serialization.json	json	0.000000	0	7	0
5	axon-messaging-4.9.3	org.axonframework.serialization.xml	xml	0.000000	0	7	0
6	axon-messaging-4.9.3	org.axonframework.tracing.attributes	attributes	0.000000	0	6	0
7	axon-messaging-4.9.3	org.axonframework.serialization.converters	converters	0.000000	0	5	0
8	axon-test-4.9.3	org.axonframework.test.server	server	0.000000	0	4	0
9	axon-messaging-4.9.3	org.axonframework.commandhandling.callbacks	callbacks	0.000000	0	4	0
10	axon-messaging-4.9.3	org.axonframework.deadline.quartz	quartz	0.000000	0	4	0
11	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.java	java	0.000000	0	4	0
12	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.jpa	jpa	0.000000	0	4	0
13	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.le...	legacyjpa	0.000000	0	3	0
14	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.job...	jobrunr	0.000000	0	3	0
15	axon-messaging-4.9.3	org.axonframework.util	util	0.000000	0	3	0
16	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.inm...	inmemory	0.000000	0	2	0
17	axon-modelling-4.9.3	org.axonframework.modelling.command.legacyjpa	legacyjpa	0.000000	0	2	0
18	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.in...	inmemory	0.000000	0	2	0
19	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.inm...	inmemory	0.000000	0	2	0
20	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.leg...	legacyjpa	0.000000	0	2	0
21	axon-messaging-4.9.3	org.axonframework.messaging.interceptors.legac...	legacyvalidation	0.000000	0	2	0
22	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.000000	0	1	0
23	axon-messaging-4.9.3	org.axonframework.common.io	io	0.000000	0	1	0
24	axon-messaging-4.9.3	org.axonframework.eventhandling.interceptors	interceptors	0.000000	0	1	0
25	axon-disruptor-4.9.3	org.axonframework.disruptor.commandhandling	commandhandling	0.045455	1	22	0
26	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.jdbc	jdbc	0.100000	1	10	0
27	axon-messaging-4.9.3	org.axonframework.eventhandling.deadletter.jpa	jpa	0.111111	1	9	0

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes	maxSubpackageDepth
28	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.jdbc	jdbc	0.111111	1	9	0
29	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore	tokenstore	0.125000	3	24	1

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
92	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdb...	statements	1.000000	15	15	0
90	axon-messaging-4.9.3	org.axonframework.common.annotation	annotation	0.666667	2	3	0
91	axon-messaging-4.9.3	org.axonframework.common.stream	stream	0.666667	2	3	0
89	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdbc	jdbc	0.620690	18	29	1
88	axon-messaging-4.9.3	org.axonframework.serialization.upcasting	upcasting	0.611111	11	18	1
86	axon-messaging-4.9.3	org.axonframework.lifecycle	lifecycle	0.600000	6	10	0
87	axon-messaging-4.9.3	org.axonframework.eventhandling.gateway	gateway	0.600000	3	5	0
83	axon-messaging-4.9.3	org.axonframework.serialization.upcasting.event	event	0.500000	6	12	0
84	axon-modelling-4.9.3	org.axonframework.modelling.saga.metamodel	metamodel	0.500000	2	4	0
85	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	0.500000	2	4	0
81	axon-messaging-4.9.3	org.axonframework.common.jdbc	jdbc	0.444444	8	18	0
82	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.conflictresolu...	conflictresolution	0.444444	4	9	0
80	axon-messaging-4.9.3	org.axonframework.common	common	0.425743	43	101	1
79	axon-configuration-4.9.3	org.axonframework.config	config	0.425000	17	40	0
75	axon-test-4.9.3	org.axonframework.test.utils	utils	0.400000	2	5	0
76	axon-test-4.9.3	org.axonframework.test.eventscheduler	eventscheduler	0.400000	2	5	0
77	axon-messaging-4.9.3	org.axonframework.deadline.annotation	annotation	0.400000	2	5	0
78	axon-messaging-4.9.3	org.axonframework.queryhandling.registration	registration	0.400000	2	5	0
74	axon-modelling-4.9.3	org.axonframework.modelling.command	command	0.390244	32	82	1
73	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	0.379747	30	79	2
71	axon-messaging-4.9.3	org.axonframework.messaging	messaging	0.375000	54	144	2
72	axon-messaging-4.9.3	org.axonframework.messaging.responsetypes	responsetypes	0.375000	3	8	0
70	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	0.368421	7	19	0
69	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	eventsourcing	0.353383	47	133	3
68	axon-modelling-4.9.3	org.axonframework.modelling.command.inspection	inspection	0.346154	9	26	0
64	axon-test-4.9.3	org.axonframework.test.saga	saga	0.333333	7	21	0
65	axon-messaging-4.9.3	org.axonframework.common.property	property	0.333333	3	9	0
66	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	0.333333	2	6	0
67	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.snapshotting	snapshotting	0.333333	1	3	0
63	axon-messaging-4.9.3	org.axonframework.queryhandling	queryhandling	0.315789	18	57	1

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-4.9.3	org.axonframework.tracing.attributes	attributes	NaN	0.000000	NaN	6
1	axon-messaging-4.9.3	org.axonframework.serialization.converters	converters	NaN	0.000000	NaN	5
2	axon-messaging-4.9.3	org.axonframework.common.io	io	NaN	0.000000	NaN	1
3	axon-messaging-4.9.3	org.axonframework.eventhandling.interceptors	interceptors	NaN	0.000000	NaN	1
4	axon-eventsourcing-4.9.3	org	org	NaN	0.000000	NaN	0
5	axon-eventsourcing-4.9.3	org.axonframework	axonframework	NaN	0.000000	NaN	0
6	axon-test-4.9.3	org	org	NaN	0.000000	NaN	0
7	axon-test-4.9.3	org.axonframework	axonframework	NaN	0.000000	NaN	0
8	axon-modelling-4.9.3	org	org	NaN	0.000000	NaN	0
9	axon-modelling-4.9.3	org.axonframework	axonframework	NaN	0.000000	NaN	0
10	axon-modelling-4.9.3	org.axonframework.modelling	modelling	NaN	0.000000	NaN	0
11	axon-disruptor-4.9.3	org	org	NaN	0.000000	NaN	0
12	axon-disruptor-4.9.3	org.axonframework	axonframework	NaN	0.000000	NaN	0
13	axon-disruptor-4.9.3	org.axonframework.disruptor	disruptor	NaN	0.000000	NaN	0
14	axon-configuration-4.9.3	org	org	NaN	0.000000	NaN	0
15	axon-configuration-4.9.3	org.axonframework	axonframework	NaN	0.000000	NaN	0
16	axon-messaging-4.9.3	org	org	NaN	0.000000	NaN	0
17	axon-messaging-4.9.3	org.axonframework	axonframework	NaN	0.000000	NaN	0
18	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdb...	statements	0.727273	1.000000	0.727273	15
19	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.666667	0.000000	0.333333	1
20	axon-messaging-4.9.3	org.axonframework.serialization	serialization	0.580971	0.294118	0.124911	34
21	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	0.566188	0.333333	0.100478	6
22	axon-messaging-4.9.3	org.axonframework.tracing	tracing	0.545620	0.263158	0.191223	19
23	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	0.500573	0.277778	0.221649	54
24	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	0.481250	0.500000	0.018750	4
25	axon-messaging-4.9.3	org.axonframework.common.jpa	jpa	0.477273	0.250000	0.272727	4
26	axon-messaging-4.9.3	org.axonframework.common.lock	lock	0.466069	0.181818	0.352113	11
27	axon-messaging-4.9.3	org.axonframework.common.legacyjpa	legacyjpa	0.450000	0.250000	0.300000	4
28	axon-messaging-4.9.3	org.axonframework.eventhandling.gateway	gateway	0.425397	0.600000	0.825397	5
29	axon-test-4.9.3	org.axonframework.test.matchers	matchers	0.419643	0.125000	0.455357	24

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-messaging-4.9.3	org.axonframework.tracing	tracing	0.733868	0.200000	0.066132	25
1	axon-messaging-4.9.3	org.axonframework.common.lock	lock	0.711039	0.181818	0.107143	11
2	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.666667	0.000000	0.333333	1
3	axon-messaging-4.9.3	org.axonframework.serialization	serialization	0.659543	0.295775	0.044683	71
4	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	0.647272	0.277778	0.074951	54
5	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	0.623656	0.333333	0.043011	6
6	axon-test-4.9.3	org.axonframework.test.matchers	matchers	0.606707	0.125000	0.268293	24
7	axon-messaging-4.9.3	org.axonframework.messaging	messaging	0.601756	0.375000	0.023244	144
8	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	unitofwork	0.600925	0.285714	0.113360	14
9	axon-messaging-4.9.3	org.axonframework.common	common	0.570333	0.425743	0.003925	101
10	axon-messaging-4.9.3	org.axonframework.eventhandling	eventhandling	0.566957	0.274678	0.158365	233
11	axon-messaging-4.9.3	org.axonframework.common.jpa	jpa	0.562500	0.250000	0.187500	4
12	axon-messaging-4.9.3	org.axonframework.common.legacyjpa	legacyjpa	0.535714	0.250000	0.214286	4
13	axon-messaging-4.9.3	org.axonframework.commandhandling	commandhandling	0.519264	0.281553	0.199183	103
14	axon-messaging-4.9.3	org.axonframework.common.property	property	0.500000	0.333333	0.166667	9
15	axon-messaging-4.9.3	org.axonframework.messaging.correlation	correlation	0.483333	0.250000	0.266667	4
16	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdb...	statements	0.480769	1.000000	0.480769	15
17	axon-messaging-4.9.3	org.axonframework.messaging.responsetypes	responsetypes	0.449324	0.375000	0.175676	8
18	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	deadletter	0.440402	0.368421	0.191176	19
19	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.snapshotting	snapshotting	0.435897	0.333333	0.230769	3
20	axon-messaging-4.9.3	org.axonframework.util	util	0.400000	0.000000	0.600000	3
21	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.in...	inmemory	0.400000	0.000000	0.600000	2
22	axon-messaging-4.9.3	org.axonframework.commandhandling.callbacks	callbacks	0.380952	0.000000	0.619048	4
23	axon-messaging-4.9.3	org.axonframework.common.jdbc	jdbc	0.377778	0.444444	0.177778	18
24	axon-messaging-4.9.3	org.axonframework.eventhandling.gateway	gateway	0.377778	0.600000	0.777778	5
25	axon-messaging-4.9.3	org.axonframework.serialization.xml	xml	0.360000	0.000000	0.640000	7
26	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.conflictresolu...	conflictresolution	0.353535	0.444444	0.909091	9
27	axon-messaging-4.9.3	org.axonframework.lifecycle	lifecycle	0.342029	0.600000	0.057971	10
28	axon-messaging-4.9.3	org.axonframework.eventhandling.async	async	0.311111	0.133333	0.555556	15
29	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed....	commandfilter	0.300000	0.000000	0.700000	7

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

axon-messaging-4.9.3
inmemory

axon-eventsourcing-4.9.3
statements

axon-messaging-4.9.3
digest

axon-messaging-4.9.3
responsetypes

axon-mess...
eventhandling