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](#)
- [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 packages with the most incoming dependencies
- Set the "incomingDependencies" properties on Package nodes.

	artifactName	packageName	incomingDependencies	incomingDependenciesWeight	incomingDependentTypes	incomingDependent
0	axon-messaging-4.9.3	org.axonframework.messaging	8706	35171	329	
1	axon-messaging-4.9.3	org.axonframework.eventhandling	5417	34593	302	
2	axon-messaging-4.9.3	org.axonframework.commandhandling	1641	7998	126	
3	axon-messaging-4.9.3	org.axonframework.serialization	1240	6854	138	
4	axon-messaging-4.9.3	org.axonframework.messaging.annotation	1057	5648	151	
5	axon-messaging-4.9.3	org.axonframework.common	926	2235	338	
6	axon-messaging-4.9.3	org.axonframework.tracing	516	2865	93	
7	axon-messaging-4.9.3	org.axonframework.common.transaction	314	1182	76	
8	axon-modelling-4.9.3	org.axonframework.modelling.command	270	1055	79	
9	axon-modelling-4.9.3	org.axonframework.modelling.saga	258	1531	60	
10	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	256	1406	82	
11	axon-messaging-4.9.3	org.axonframework.deadline	238	1845	42	
12	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdbc	218	1404	26	
13	axon-messaging-4.9.3	org.axonframework.queryhandling	218	1107	55	
14	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	200	1548	35	
15	axon-messaging-4.9.3	org.axonframework.monitoring	188	640	39	
16	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	169	816	60	
17	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	145	701	44	
18	axon-configuration-4.9.3	org.axonframework.config	119	1560	35	
19	axon-messaging-4.9.3	org.axonframework.commandhandling.gateway	97	395	33	

Table 1b

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

	artifactName	packageName	incomingDependencies	incomingDependenciesWeight	incomingDependentTypes	incomingDependentInt
0	axon-messaging-4.9.3	org.axonframework.messaging	7692	34146	328	
1	axon-messaging-4.9.3	org.axonframework.eventhandling	3139	18167	143	
2	axon-messaging-4.9.3	org.axonframework.common	1269	3934	360	
3	axon-messaging-4.9.3	org.axonframework.serialization	1076	6084	92	
4	axon-messaging-4.9.3	org.axonframework.messaging.annotation	938	5202	106	
5	axon-messaging-4.9.3	org.axonframework.commandhandling	784	4609	57	
6	axon-messaging-4.9.3	org.axonframework.tracing	466	2627	72	
7	axon-messaging-4.9.3	org.axonframework.common.transaction	308	1166	73	
8	axon-messaging-4.9.3	org.axonframework.messaging.unitofwork	219	1143	71	
9	axon-messaging-4.9.3	org.axonframework.monitoring	178	604	34	
10	axon-messaging-4.9.3	org.axonframework.messaging.deadletter	167	1382	20	
11	axon-modelling-4.9.3	org.axonframework.modelling.command	160	607	37	
12	axon-messaging-4.9.3	org.axonframework.deadline	114	1079	19	
13	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	105	505	14	
14	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	85	313	23	
15	axon-modelling-4.9.3	org.axonframework.modelling.saga	75	247	18	
16	axon-messaging-4.9.3	org.axonframework.lifecycle	65	197	19	
17	axon-messaging-4.9.3	org.axonframework.messaging.responsetypes	61	436	14	
18	axon-messaging-4.9.3	org.axonframework.queryhandling	57	192	8	
19	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore	47	207	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 packages with the most outgoing dependencies
- Set the "outgoingDependencies" properties on Package nodes.

	artifactName	packageName	outgoingDependencies	outgoingDependenciesWeight	outgoingDependentTypes	outgoingDependent
0	axon-configuration-4.9.3	org.axonframework.config	10226	43714	242	
1	axon-test-4.9.3	org.axonframework.test.aggregate	2223	9766	92	
2	axon-messaging-4.9.3	org.axonframework.eventhandling	1565	8066	160	
3	axon-disruptor-4.9.3	org.axonframework.disruptor.commandhandling	1487	7444	85	
4	axon-test-4.9.3	org.axonframework.test.saga	1487	5146	82	
5	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdbc	1340	8129	51	
6	axon-messaging-4.9.3	org.axonframework.queryhandling	1141	7105	86	
7	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	1009	4309	95	
8	axon-messaging-4.9.3	org.axonframework.eventhandling.pooled	892	5306	56	
9	axon-modelling-4.9.3	org.axonframework.modelling.command	847	4243	94	
10	axon-modelling-4.9.3	org.axonframework.modelling.command.inspection	781	4141	73	
11	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed	738	2842	74	
12	axon-messaging-4.9.3	org.axonframework.commandhandling	691	2432	74	
13	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	615	2542	65	
14	axon-messaging-4.9.3	org.axonframework.eventhandling.deadletter.jdbc	581	4165	49	
15	axon-messaging-4.9.3	org.axonframework.deadline.dbscheduler	488	2642	40	
16	axon-messaging-4.9.3	org.axonframework.deadline.quartz	453	2099	40	
17	axon-messaging-4.9.3	org.axonframework.commandhandling.gateway	443	1608	56	
18	axon-modelling-4.9.3	org.axonframework.modelling.saga	432	1954	62	
19	axon-messaging-4.9.3	org.axonframework.deadline.jobrunr	419	1803	37	

Table 2b

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

	artifactName	packageName	outgoingDependencies	outgoingDependenciesWeight	outgoingDependentTypes	outgoingDependent
0	axon-messaging-4.9.3	org.axonframework.eventhandling	588	2506	106	
1	axon-configuration-4.9.3	org.axonframework.config	542	1866	202	
2	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing	381	1735	95	
3	axon-test-4.9.3	org.axonframework.test	275	1022	100	
4	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	246	1203	58	
5	axon-modelling-4.9.3	org.axonframework.modelling.command	230	990	63	
6	axon-messaging-4.9.3	org.axonframework.eventhandling.deadletter	208	1215	57	
7	axon-messaging-4.9.3	org.axonframework.commandhandling	195	591	67	
8	axon-messaging-4.9.3	org.axonframework.deadline	190	800	48	
9	axon-messaging-4.9.3	org.axonframework.messaging	183	593	27	
10	axon-messaging-4.9.3	org.axonframework.queryhandling	175	746	51	
11	axon-modelling-4.9.3	org.axonframework.modelling.saga	156	603	58	
12	axon-test-4.9.3	org.axonframework.test.aggregate	150	670	74	
13	axon-disruptor-4.9.3	org.axonframework.disruptor.commandhandling	131	607	63	
14	axon-modelling-4.9.3	org.axonframework.modelling.command.inspection	119	551	51	
15	axon-test-4.9.3	org.axonframework.test.saga	112	469	61	
16	axon-messaging-4.9.3	org.axonframework.eventhandling.pooled	106	597	35	
17	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository	104	558	34	
18	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed	93	319	48	
19	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling	88	362	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 packages with the lowest *Instability*
- Set the property "instability" on Package nodes.

	p.fqn	p.name	instability	instabilityTypes	instabilityInterfaces	instabilityPackages	instabilityArtifacts	p.outgoingDe
0	org.axonframework.messaging	messaging	0.015047	0.096154	0.185185	0.101695	0.0	
1	org.axonframework.common.transaction	transaction	0.018750	0.050000	0.000000	0.034483	0.0	
2	org.axonframework.common	common	0.024236	0.042493	0.000000	0.012658	0.0	
3	org.axonframework.eventhandling.scheduling	scheduling	0.090909	0.142857	0.000000	0.222222	0.0	
4	org.axonframework.monitoring	monitoring	0.100478	0.152174	0.333333	0.230769	0.0	
5	org.axonframework.common.annotation	annotation	0.120000	0.120000	0.000000	0.166667	0.0	
6	org.axonframework.lifecycle	lifecycle	0.123457	0.233333	0.000000	0.176471	0.0	
7	org.axonframework.serialization	serialization	0.124294	0.250000	0.318182	0.214286	0.0	
8	org.axonframework.common.stream	stream	0.147059	0.166667	0.000000	0.125000	0.0	
9	org.axonframework.tracing	tracing	0.191223	0.225000	0.480000	0.333333	0.0	
10	org.axonframework.messaging.annotation	annotation	0.221649	0.307339	0.406250	0.218750	0.0	
11	org.axonframework.eventhandling	eventhandling	0.224148	0.346320	0.500000	0.258065	0.0	
12	org.axonframework.common.jpa	jpa	0.272727	0.250000	1.000000	0.300000	0.0	
13	org.axonframework.commandhandling	commandhandling	0.296312	0.370000	0.612245	0.333333	0.0	
14	org.axonframework.common.legacyjpa	legacyjpa	0.300000	0.277778	1.000000	0.333333	0.0	
15	org.axonframework.serialization.upcasting	upcasting	0.312500	0.083333	0.000000	0.333333	0.0	
16	org.axonframework.messaging.unitofwork	unitofwork	0.324538	0.196078	0.583333	0.121951	0.0	
17	org.axonframework.common.digest	digest	0.333333	0.333333	0.000000	0.333333	0.0	
18	org.axonframework.messaging.deadletter	deadletter	0.344262	0.396552	0.500000	0.454545	0.0	
19	org.axonframework.common.lock	lock	0.352113	0.363636	0.500000	0.222222	0.0	

Table 3b

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

	p.fqn	p.name	instability	instabilityTypes	instabilityInterfaces	instabilityPackages	instabilityArtifacts	p.outgoingl
0	org.axonframework.common	common	0.003925	0.013699	0.000000	0.027778	0.0	
1	org.axonframework.messaging	messaging	0.023238	0.076056	0.400000	0.133333	0.0	
2	org.axonframework.monitoring	monitoring	0.043011	0.055556	0.454545	0.181818	0.0	
3	org.axonframework.serialization	serialization	0.044405	0.206897	0.200000	0.222222	0.0	
4	org.axonframework.lifecycle	lifecycle	0.057971	0.095238	0.000000	0.133333	0.0	
5	org.axonframework.tracing	tracing	0.066132	0.162791	0.187500	0.333333	0.0	
6	org.axonframework.messaging.annotation	annotation	0.074951	0.158730	0.424242	0.200000	0.0	
7	org.axonframework.common.annotation	annotation	0.086957	0.086957	0.000000	0.100000	0.0	
8	org.axonframework.common.lock	lock	0.107143	0.142857	0.000000	0.142857	0.0	
9	org.axonframework.messaging.unitofwork	unitofwork	0.113360	0.101266	0.375000	0.102564	0.0	
10	org.axonframework.eventhandling	eventhandling	0.157768	0.425703	0.463636	0.425532	0.0	
11	org.axonframework.common.property	property	0.166667	0.250000	0.000000	0.200000	0.0	
12	org.axonframework.messaging.responsetypes	responsetypes	0.175676	0.416667	0.000000	0.625000	0.0	
13	org.axonframework.common.jdbc	jdbc	0.177778	0.259259	0.000000	0.333333	0.0	
14	org.axonframework.common.jpa	jpa	0.187500	0.142857	0.000000	0.250000	0.0	
15	org.axonframework.messaging.deadletter	deadletter	0.189320	0.310345	0.466667	0.444444	0.0	
16	org.axonframework.commandhandling	commandhandling	0.199183	0.540323	0.512821	0.500000	0.0	
17	org.axonframework.common.legacyjpa	legacyjpa	0.214286	0.166667	0.000000	0.285714	0.0	
18	org.axonframework.eventsourcing.snapshotting	snapshotting	0.230769	0.307692	0.500000	0.375000	0.0	
19	org.axonframework.messaging.correlation	correlation	0.266667	0.222222	0.500000	0.250000	0.0	

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-modelling-4.9.3	org.axonframework.modelling.command.legacyjpa	legacyjpa	0.0	0	2
18	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.in...	inmemory	0.0	0	2
19	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.inm...	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-modelling-4.9.3	org	org	0.0	0	0
27	axon-modelling-4.9.3	org.axonframework	axonframework	0.0	0	0
28	axon-modelling-4.9.3	org.axonframework.modelling	modelling	0.0	0	0
29	axon-test-4.9.3	org	org	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	numberOfIncludedSubPackag
0	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.leg...	legacyjpa	0.000000	0	10	
1	axon-messaging-4.9.3	org.axonframework.commandhandling.distributed....	commandfilter	0.000000	0	7	
2	axon-messaging-4.9.3	org.axonframework.deadline.dbscheduler	dbscheduler	0.000000	0	7	
3	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.dbs...	dbscheduler	0.000000	0	7	
4	axon-messaging-4.9.3	org.axonframework.serialization.json	json	0.000000	0	7	
5	axon-messaging-4.9.3	org.axonframework.serialization.xml	xml	0.000000	0	7	
6	axon-messaging-4.9.3	org.axonframework.tracing.attributes	attributes	0.000000	0	6	
7	axon-messaging-4.9.3	org.axonframework.serialization.converters	converters	0.000000	0	5	
8	axon-test-4.9.3	org.axonframework.test.server	server	0.000000	0	4	
9	axon-messaging-4.9.3	org.axonframework.commandhandling.callbacks	callbacks	0.000000	0	4	
10	axon-messaging-4.9.3	org.axonframework.deadline.quartz	quartz	0.000000	0	4	
11	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.java	java	0.000000	0	4	
12	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.jpa	jpa	0.000000	0	4	
13	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.le...	legacyjpa	0.000000	0	3	
14	axon-messaging-4.9.3	org.axonframework.eventhandling.scheduling.job...	jobrunr	0.000000	0	3	
15	axon-messaging-4.9.3	org.axonframework.util	util	0.000000	0	3	
16	axon-modelling-4.9.3	org.axonframework.modelling.command.legacyjpa	legacyjpa	0.000000	0	2	
17	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.in...	inmemory	0.000000	0	2	
18	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.inm...	inmemory	0.000000	0	2	
19	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.inm...	inmemory	0.000000	0	2	
20	axon-messaging-4.9.3	org.axonframework.eventhandling.tokenstore.leg...	legacyjpa	0.000000	0	2	
21	axon-messaging-4.9.3	org.axonframework.messaging.interceptors.legac...	legacyvalidation	0.000000	0	2	
22	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.000000	0	1	
23	axon-messaging-4.9.3	org.axonframework.common.io	io	0.000000	0	1	
24	axon-messaging-4.9.3	org.axonframework.eventhandling.interceptors	interceptors	0.000000	0	1	
25	axon-disruptor-4.9.3	org.axonframework.disruptor.commandhandling	commandhandling	0.045455	1	22	
26	axon-modelling-4.9.3	org.axonframework.modelling.saga.repository.jdbc	jdbc	0.100000	1	10	

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

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	numberOfIncludedSubPackages
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	11
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	2
73	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore	eventstore	0.379747	30	79	5
71	axon-messaging-4.9.3	org.axonframework.messaging	messaging	0.375000	54	144	7
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	8
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

	artifactName	fullQualifiedPackageName	packageName	abstractness	numberAbstractTypes	numberTypes	numberOfIncludedSubPackages
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	2

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	fullQualifiedPackageName	packageName	distance	abstractness	instability	typesInPackage
0	axon-messaging-4.9.3	org.axonframework.common.io	io	1.000000	0.000000	0.000000	1
1	axon-modelling-4.9.3	org	org	1.000000	0.000000	0.000000	0
2	axon-modelling-4.9.3	org.axonframework	axonframework	1.000000	0.000000	0.000000	0
3	axon-modelling-4.9.3	org.axonframework.modelling	modelling	1.000000	0.000000	0.000000	0
4	axon-test-4.9.3	org	org	1.000000	0.000000	0.000000	0
5	axon-test-4.9.3	org.axonframework	axonframework	1.000000	0.000000	0.000000	0
6	axon-eventsourcing-4.9.3	org	org	1.000000	0.000000	0.000000	0
7	axon-eventsourcing-4.9.3	org.axonframework	axonframework	1.000000	0.000000	0.000000	0
8	axon-messaging-4.9.3	org	org	1.000000	0.000000	0.000000	0
9	axon-messaging-4.9.3	org.axonframework	axonframework	1.000000	0.000000	0.000000	0
10	axon-disruptor-4.9.3	org	org	1.000000	0.000000	0.000000	0
11	axon-disruptor-4.9.3	org.axonframework	axonframework	1.000000	0.000000	0.000000	0
12	axon-disruptor-4.9.3	org.axonframework.disruptor	disruptor	1.000000	0.000000	0.000000	0
13	axon-configuration-4.9.3	org	org	1.000000	0.000000	0.000000	0
14	axon-configuration-4.9.3	org.axonframework	axonframework	1.000000	0.000000	0.000000	0
15	axon-eventsourcing-4.9.3	org.axonframework.eventsourcing.eventstore.jdb...	statements	0.727273	1.000000	0.727273	15
16	axon-messaging-4.9.3	org.axonframework.common.digest	digest	0.666667	0.000000	0.333333	1
17	axon-messaging-4.9.3	org.axonframework.serialization	serialization	0.581589	0.294118	0.124294	34
18	axon-messaging-4.9.3	org.axonframework.monitoring	monitoring	0.566188	0.333333	0.100478	6
19	axon-messaging-4.9.3	org.axonframework.tracing	tracing	0.545620	0.263158	0.191223	19
20	axon-messaging-4.9.3	org.axonframework.messaging.annotation	annotation	0.500573	0.277778	0.221649	54
21	axon-messaging-4.9.3	org.axonframework.common.transaction	transaction	0.481250	0.500000	0.018750	4
22	axon-messaging-4.9.3	org.axonframework.common.jpa	jpa	0.477273	0.250000	0.272727	4
23	axon-messaging-4.9.3	org.axonframework.common.lock	lock	0.466069	0.181818	0.352113	11
24	axon-messaging-4.9.3	org.axonframework.common.legacyjpa	legacyjpa	0.450000	0.250000	0.300000	4
25	axon-messaging-4.9.3	org.axonframework.eventhandling.gateway	gateway	0.425397	0.600000	0.825397	5
26	axon-test-4.9.3	org.axonframework.test.matchers	matchers	0.419643	0.125000	0.455357	24
27	axon-configuration-4.9.3	org.axonframework.config	config	0.413497	0.425000	0.988497	40
28	axon-messaging-4.9.3	org.axonframework.util	util	0.400000	0.000000	0.600000	3
29	axon-messaging-4.9.3	org.axonframework.messaging.correlation	correlation	0.391026	0.250000	0.358974	4

Table 5b

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

	artifactName	fullQualifiedPackageName	packageName	distance	abstractness	instability	typesInPackage
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	0.659820	0.295775	0.044405	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	0.601762	0.375000	0.023238	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	0.567554	0.274678	0.157768	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	0.442259	0.368421	0.189320	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)
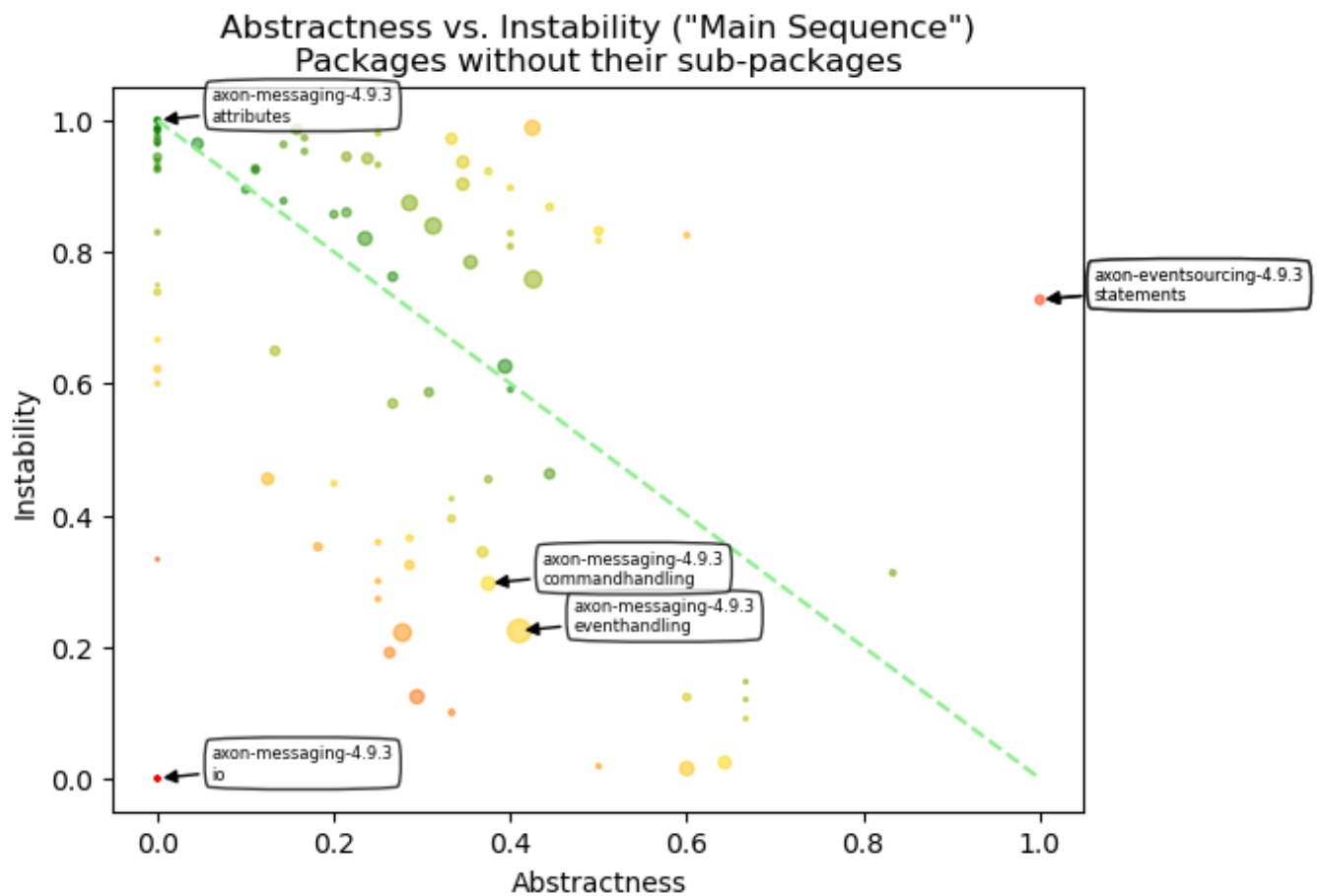
Figure 1a - Packages without their sub-packages

Figure 1b - Packages including their sub-packages

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