

Package Dependencies for Java with Neo4j

References

- [Analyze java package metrics in a graph database](#)
- [Calculate metrics](#)
- [py2neo](#)

Artifacts

Table 1

- List all the artifacts this notebook is based on

	artifactName	packages	types
0	axon-test-4.7.5.jar	8	85
1	axon-disruptor-4.7.5.jar	1	22
2	axon-eventsourcing-4.7.5.jar	9	130
3	axon-messaging-4.7.5.jar	61	729
4	axon-modelling-4.7.5.jar	10	149
5	axon-configuration-4.7.5.jar	1	39

Cyclic Dependencies

Cyclic dependencies occur when one package uses a class of another package and vice versa. These dependencies can lead to a lot of trouble when one of these packages needs to be changed.

Table 2

- List packages with cyclic dependencies

	packageName	dependentPackageName	forwardToBackwardBalance	numberForward	numberBackward	
0	org.axonframework.eventhandling	org.axonframework.tracing	0.857143	13	1	[
1	org.axonframework.eventhandling	org.axonframework.messaging.annotation	0.840000	23	2	[Tr
2	org.axonframework.eventhandling	org.axonframework.messaging	0.837838	34	3	
3	org.axonframework.queryhandling	org.axonframework.tracing	0.800000	9	1	
4	org.axonframework.eventsourcing	org.axonframework.eventsourcing.eventstore	0.764706	15	2	[E
5	org.axonframework.deadline	org.axonframework.tracing	0.750000	7	1	[S
6	org.axonframework.commandhandling.callbacks	org.axonframework.commandhandling	0.733333	13	2	[L
7	org.axonframework.messaging.unitofwork	org.axonframework.messaging	0.647059	14	3	[A
8	org.axonframework.eventhandling	org.axonframework.serialization	0.600000	12	3	[
9	org.axonframework.eventhandling.async	org.axonframework.eventhandling	0.538462	10	3	[F
10	org.axonframework.commandhandling	org.axonframework.tracing	0.500000	3	1	[A
11	org.axonframework.eventhandling.replay	org.axonframework.eventhandling	0.454545	8	3	
12	org.axonframework.eventhandling	org.axonframework.eventhandling.tokenstore	0.333333	8	4	
13	org.axonframework.serialization.upcasting.event	org.axonframework.eventhandling	0.333333	6	3	
14	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.eventsourcing.eventstore.jdbc...	0.317073	27	14	[Jd
15	org.axonframework.queryhandling.registration	org.axonframework.queryhandling	0.250000	5	3	[f
16	org.axonframework.messaging.annotation	org.axonframework.messaging.interceptors	0.200000	3	2	
17	org.axonframework.messaging	org.axonframework.serialization	0.157895	11	8	
18	org.axonframework.modelling.saga	org.axonframework.modelling.saga.metamodel	0.142857	4	3	
19	org.axonframework.commandhandling.distributed....	org.axonframework.commandhandling.distributed	0.076923	7	6	
20	org.axonframework.modelling.command.inspection	org.axonframework.modelling.command	0.040000	13	12	[Ch

Table 3

- List packages with cyclic dependencies with every dependency in a separate row sorted by the easiest and most valuable to resolve

	packageName	dependentPackageName	dependency	forwardToBackwardBalance	numberFor
0	org.axonframework.eventhandling	org.axonframework.tracing	EventMessage<-NestingSpanFactory	0.857143	
1	org.axonframework.eventhandling	org.axonframework.tracing	SubscribingEventProcessor\$Builder->SpanFactory	0.857143	
2	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor->SpanFactory	0.857143	
3	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor->Span	0.857143	
4	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor->Span	0.857143	
5	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor->SpanFactory	0.857143	
6	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor\$Builder->SpanFactory	0.857143	
7	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus\$Builder->NoOpSpanFactory	0.857143	
8	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus\$Builder->SpanFactory	0.857143	
9	org.axonframework.eventhandling	org.axonframework.tracing	SimpleEventBus\$Builder->SpanFactory	0.857143	
10	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor\$Builder->SpanFactory	0.857143	
11	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor\$Builder->NoOpSpanFactory	0.857143	
12	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus->SpanFactory	0.857143	
13	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus->Span	0.857143	
14	org.axonframework.eventhandling	org.axonframework.messaging.annotation	DomainEventMessage<-SourceIdParameterResolverF...	0.840000	
15	org.axonframework.eventhandling	org.axonframework.messaging.annotation	DomainEventMessage<-AggregateTypeParameterReso...	0.840000	
16	org.axonframework.eventhandling	org.axonframework.messaging.annotation	TrackingTokenParameterResolverFactory->Paramet...	0.840000	
17	org.axonframework.eventhandling	org.axonframework.messaging.annotation	TrackingTokenParameterResolverFactory->Paramet...	0.840000	
18	org.axonframework.eventhandling	org.axonframework.messaging.annotation	EventHandler->MessageHandler	0.840000	
19	org.axonframework.eventhandling	org.axonframework.messaging.annotation	SimpleEventHandlerInvoker\$Builder->HandlerDefi...	0.840000	
20	org.axonframework.eventhandling	org.axonframework.messaging.annotation	SimpleEventHandlerInvoker\$Builder->ParameterRe...	0.840000	
21	org.axonframework.eventhandling	org.axonframework.messaging.annotation	TimestampParameterResolverFactory\$TimestampPar...	0.840000	
22	org.axonframework.eventhandling	org.axonframework.messaging.annotation	TrackingTokenParameterResolverFactory\$Tracking...	0.840000	
23	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AllowReplay->HasHandlerAttributes	0.840000	
24	org.axonframework.eventhandling	org.axonframework.messaging.annotation	TimestampParameterResolverFactory->ParameterRe...	0.840000	
25	org.axonframework.eventhandling	org.axonframework.messaging.annotation	TimestampParameterResolverFactory->AbstractAnn...	0.840000	
26	org.axonframework.eventhandling	org.axonframework.messaging.annotation	ConcludesBatchParameterResolverFactory->Abstra...	0.840000	
27	org.axonframework.eventhandling	org.axonframework.messaging.annotation	ConcludesBatchParameterResolverFactory->Parame...	0.840000	
28	org.axonframework.eventhandling	org.axonframework.messaging.annotation	SequenceNumberParameterResolverFactory\$Sequenc...	0.840000	
29	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->MessageHandling...	0.840000	
30	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->HandlerDefinition	0.840000	
31	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->ClasspathParame...	0.840000	
32	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->AnnotatedHandle...	0.840000	
33	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->ParameterResolv...	0.840000	
34	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->ClasspathHandle...	0.840000	
35	org.axonframework.eventhandling	org.axonframework.messaging.annotation	AnnotationEventHandlerAdapter->MessageHandlerI...	0.840000	
36	org.axonframework.eventhandling	org.axonframework.messaging.annotation	ResetHandler->MessageHandler	0.840000	
37	org.axonframework.eventhandling	org.axonframework.messaging.annotation	SequenceNumberParameterResolverFactory->Abstra...	0.840000	
38	org.axonframework.eventhandling	org.axonframework.messaging.annotation	SequenceNumberParameterResolverFactory->Parame...	0.840000	
39	org.axonframework.eventhandling	org.axonframework.messaging	TrackingToken<-StreamableMessageSource	0.837838	
40	org.axonframework.eventhandling	org.axonframework.messaging	EventMessage<-Headers	0.837838	
41	org.axonframework.eventhandling	org.axonframework.messaging	DomainEventMessage<-Headers	0.837838	
42	org.axonframework.eventhandling	org.axonframework.messaging	MultiStreamableMessageSource->StreamableMessag...	0.837838	
43	org.axonframework.eventhandling	org.axonframework.messaging	TimestampParameterResolverFactory\$TimestampPar...	0.837838	
44	org.axonframework.eventhandling	org.axonframework.messaging	GenericDomainEventMessage->MetaData	0.837838	
45	org.axonframework.eventhandling	org.axonframework.messaging	GenericDomainEventMessage->GenericMessage	0.837838	
46	org.axonframework.eventhandling	org.axonframework.messaging	GenericDomainEventMessage->Message	0.837838	
47	org.axonframework.eventhandling	org.axonframework.messaging	MultiStreamableMessageSource\$IdentifiedStream...	0.837838	
48	org.axonframework.eventhandling	org.axonframework.messaging	SubscribingEventProcessor\$Builder->Subscribabl...	0.837838	
49	org.axonframework.eventhandling	org.axonframework.messaging	EventMessageHandler->Message	0.837838	
50	org.axonframework.eventhandling	org.axonframework.messaging	EventMessageHandler->MessageHandler	0.837838	
51	org.axonframework.eventhandling	org.axonframework.messaging	TrackingTokenParameterResolverFactory\$Tracking...	0.837838	
52	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->Message	0.837838	
53	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->StreamableMessageSource	0.837838	

	packageName	dependentPackageName	dependency	forwardToBackwardBalance	numberFoi
54	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->InterceptorChain	0.837838	
55	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->ResultMessage	0.837838	
56	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->MessageHandlerInterceptor	0.837838	
57	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->DefaultInterceptorChain	0.837838	
58	org.axonframework.eventhandling	org.axonframework.messaging	GenericTrackedEventMessage->Message	0.837838	
59	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor\$Builder->StreamableMess...	0.837838	

Interface Segregation Candidates

Well known from [Design Principles and Design Patterns by Robert C. Martin](#), the *Interface Segregation Principle* suggests that software components should have narrow, focused interfaces rather than large, general-purpose ones. The goal is to minimize the dependencies between components and increase modularity, flexibility, and maintainability.

Smaller, focused and purpose-driven interfaces

- make it easier to modify individual components without affecting the rest of the system.
- make it clearer which client is affected by which change.
- don't force their clients to depend on methods they don't need.
- reduce the scope of changes since a change to one component doesn't affect others.
- lead to a more loosely coupled architecture that is easier to understand and maintain.

Reference: [Analyze java package metrics in a graph database](#)

How to apply the results

If just one method of a type is used, especially in many places, then the result of this method can be used to call e.g. a method or construct an object instead of using the whole object and then just calling that single method.

If there are a couple of methods that are used for a distinct purpose, those could be factored out into a separate interface. The original type can extended/implement the new interface so that there are no breaking changes. Then all the callers, that use only this group of methods, can be changed to the new interface.

Table 3

- List top 20 most used combinations of methods of larger Types that might benefit from *Interface Segregation*

	dependentType.fqn	declaredMethods	calledMethodNames	calledMethods	callerTypes
0	org.axonframework.commandhandling.CommandMessage	9	[getCommandName]	1	17
1	org.axonframework.eventhandling.DomainEventMes...	10	[getSequenceNumber]	1	8
2	org.axonframework.eventhandling.EventMessage	9	[getTimestamp, getIdentifier]	2	8
3	org.axonframework.eventhandling.EventMessage	9	[getIdentifier]	1	8
4	org.axonframework.eventhandling.TrackedEventMe...	10	[trackingToken]	1	7
5	org.axonframework.eventhandling.DomainEventMes...	10	[getType, getSequenceNumber, getAggregateIdent...	3	5
6	org.axonframework.commandhandling.GenericComma...	15	[asCommandResultMessage]	1	4
7	org.axonframework.commandhandling.GenericComma...	14	[asCommandResultMessage]	1	4
8	org.axonframework.eventhandling.TrackedEventMe...	12	[trackingToken]	1	4
9	org.axonframework.deadline.GenericDeadlineMessage	11	[asDeadlineMessage]	1	4
10	org.axonframework.deadline.DeadlineMessage	10	[getDeadlineName]	1	4
11	org.axonframework.eventhandling.DomainEventMes...	10	[getType]	1	4
12	org.axonframework.eventhandling.DomainEventMes...	10	[getAggregateIdentifier]	1	4
13	org.axonframework.eventhandling.GenericEventMe...	10	[asEventMessage]	1	4
14	org.axonframework.messaging.ResultMessage	9	[isExceptional, exceptionResult]	2	4
15	org.axonframework.common.transaction.NoTransac...	4	[instance]	1	4
16	org.axonframework.modelling.command.inspection...	13	[type]	1	3
17	org.axonframework.eventhandling.DomainEventMes...	11	[getType, getSequenceNumber, getAggregateIdent...	3	3
18	org.axonframework.eventhandling.DomainEventMes...	10	[getSequenceNumber, getAggregateIdentifier]	2	3
19	org.axonframework.eventhandling.GapAwareTracki...	10	[advanceTo, getGaps, withGapsTruncatedAt, getl...	5	3

Package Usage

Types that are used by multiple packages

Table 4

- List the top 20 packages that are used by the highest count of different packages

	dependentType.fqn	dependentType.name	dependentTypeLabels	numberOfUsingPackages
0	org.axonframework.common.BuilderUtils	BuilderUtils	[Type, File, Java, ByteCode, Class]	41
1	org.axonframework.messaging.Message	Message	[Type, File, Java, ByteCode, GenericDeclaratio...	35
2	org.axonframework.common.AxonConfigurationException	AxonConfigurationException	[Type, File, Java, ByteCode, Class]	35
3	org.axonframework.eventhandling.EventMessage	EventMessage	[Type, File, Java, ByteCode, GenericDeclaratio...	30
4	org.axonframework.messaging.unitofwork.UnitOfWork	UnitOfWork	[Type, File, Java, ByteCode, GenericDeclaratio...	29
5	org.axonframework.messaging.Metadata	Metadata	[Type, File, Java, ByteCode, Class]	29
6	org.axonframework.common.Assert	Assert	[Type, File, Java, ByteCode, Class]	25
7	org.axonframework.serialization.Serializer	Serializer	[Type, File, Java, ByteCode, Interface]	25
8	org.axonframework.common.transaction.TransactionManager	TransactionManager	[Type, File, Java, ByteCode, Interface]	23
9	org.axonframework.messaging.unitofwork.CurrentUnitOfWork	CurrentUnitOfWork	[Type, File, Java, ByteCode, Class]	21
10	org.axonframework.serialization.SerializedType	SerializedType	[Type, File, Java, ByteCode, Interface]	20
11	org.axonframework.serialization.SerializedObject	SerializedObject	[Type, File, Java, ByteCode, GenericDeclaratio...	20
12	org.axonframework.common.AxonNonTransientException	AxonNonTransientException	[Type, File, Java, ByteCode, Class]	18
13	org.axonframework.messaging.annotation.ParameterResolverFactory	ParameterResolverFactory	[Type, File, Java, ByteCode, Interface]	18
14	org.axonframework.eventhandling.TrackingToken	TrackingToken	[Type, File, Java, ByteCode, Interface]	17
15	org.axonframework.eventhandling.DomainEventMessage	DomainEventMessage	[Type, File, Java, ByteCode, GenericDeclaratio...	17
16	org.axonframework.eventhandling.GenericEventMessage	GenericEventMessage	[Type, File, Java, ByteCode, Class, GenericDec...	16
17	org.axonframework.common.Registration	Registration	[Type, File, Java, ByteCode, Interface]	16
18	org.axonframework.common.ObjectUtils	ObjectUtils	[Type, File, Java, ByteCode, Class]	15
19	org.axonframework.commandhandling.CommandMessage	CommandMessage	[Type, File, Java, ByteCode, GenericDeclaratio...	14

Packages that are used by multiple artifacts

Table 5

- List the top 20 artifacts that only use a few (compared to all existing) packages of another artifact

	artifactName	dependentArtifactName	dependentPackages	dependentArtifactPackages	packageUsagePercentage	dependentFullQualifiedPackageNames
0	axon-disruptor-4.7.5	axon-messaging-4.7.5	9	61	0.147541	[org.axonframework.commandhandling.callbacks, ...]
1	axon-test-4.7.5	axon-messaging-4.7.5	10	61	0.163934	[org.axonframework.common, org.axonframework.e...]
2	axon-disruptor-4.7.5	axon-modelling-4.7.5	2	10	0.200000	[org.axonframework.modelling.command, org.axon...]
3	axon-eventsourcing-4.7.5	axon-modelling-4.7.5	2	10	0.200000	[org.axonframework.modelling.command, org.axon...]
4	axon-test-4.7.5	axon-eventsourcing-4.7.5	2	9	0.222222	[org.axonframework.eventsourcing.eventstore, o...]
5	axon-disruptor-4.7.5	axon-eventsourcing-4.7.5	2	9	0.222222	[org.axonframework.eventsourcing.eventstore, o...]
6	axon-modelling-4.7.5	axon-messaging-4.7.5	18	61	0.295082	[org.axonframework.common.annotation, org.axon...]
7	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	20	61	0.327869	[org.axonframework.commandhandling, org.axonfr...]
8	axon-test-4.7.5	axon-modelling-4.7.5	4	10	0.400000	[org.axonframework.modelling.saga, org.axonfra...]
9	axon-configuration-4.7.5	axon-eventsourcing-4.7.5	4	9	0.444444	[org.axonframework.eventsourcing.eventstore, o...]
10	axon-configuration-4.7.5	axon-messaging-4.7.5	34	61	0.557377	[org.axonframework.common.jpa, org.axonframewo...]
11	axon-modelling-4.7.5	axon-modelling-4.7.5	6	10	0.600000	[org.axonframework.modelling.saga.metamodel, o...]
12	axon-configuration-4.7.5	axon-modelling-4.7.5	6	10	0.600000	[org.axonframework.modelling.command.inspectio...]
13	axon-test-4.7.5	axon-test-4.7.5	5	8	0.625000	[org.axonframework.test, org.axonframework.tes...]
14	axon-messaging-4.7.5	axon-messaging-4.7.5	40	61	0.655738	[org.axonframework.util, org.axonframework.com...]
15	axon-eventsourcing-4.7.5	axon-eventsourcing-4.7.5	7	9	0.777778	[org.axonframework.eventsourcing.eventstore, o...]
16	axon-configuration-4.7.5	axon-disruptor-4.7.5	1	1	1.000000	[org.axonframework.disruptor.commandhandling]

Packages that are used by multiple artifacts

Table 6

- List the top 20 packages that only use a few (compared to all existing) types of another package

	artifactName	dependentArtifactName	packageName	dependentPackage.fqn	dependentTypes	dependentPackageType
0	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	org.axonframework.eventhandling	1	
1	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.snapshotting	org.axonframework.eventhandling	1	
2	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.saga.metamodel	org.axonframework.eventhandling	1	
3	axon-eventsourcing-4.7.5	axon-modelling-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.modelling.command	1	
4	axon-eventsourcing-4.7.5	axon-modelling-4.7.5	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.modelling.command	1	
5	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.eventscheduler	org.axonframework.eventhandling	2	
6	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.eventhandling	2	
7	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.command	org.axonframework.eventhandling	2	
8	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.command.legacyjpa	org.axonframework.eventhandling	2	
9	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test	org.axonframework.messaging	1	
10	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	org.axonframework.messaging	1	
11	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.messaging	1	
12	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore	org.axonframework.messaging	1	
13	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.serialization	1	
14	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.jpa	org.axonframework.serialization	1	
15	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.legacyjpa	org.axonframework.serialization	1	
16	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.eventhandling	3	
17	axon-test-4.7.5	axon-modelling-4.7.5	org.axonframework.test.utils	org.axonframework.modelling.saga	1	
18	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	org.axonframework.commandhandling	1	
19	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.commandhandling	1	