

# 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.queryhandling	org.axonframework.messaging.responsetypes	0.875000	15	1	[Str
1	org.axonframework.eventhandling	org.axonframework.tracing	0.857143	13	1	
2	org.axonframework.eventhandling	org.axonframework.messaging	0.853659	38	3	[St
3	org.axonframework.eventhandling	org.axonframework.messaging.annotation	0.840000	23	2	[T
4	org.axonframework.eventsourcing	org.axonframework.eventsourcing.eventstore	0.777778	16	2	[A
5	org.axonframework.deadline	org.axonframework.tracing	0.750000	7	1	
6	org.axonframework.commandhandling.callbacks	org.axonframework.commandhandling	0.733333	13	2	[Fi
7	org.axonframework.queryhandling	org.axonframework.tracing	0.714286	6	1	[
8	org.axonframework.commandhandling	org.axonframework.tracing	0.666667	5	1	[As
9	org.axonframework.eventhandling	org.axonframework.serialization	0.647059	14	3	
10	org.axonframework.messaging.unitofwork	org.axonframework.messaging	0.647059	14	3	[
11	org.axonframework.eventhandling.async	org.axonframework.eventhandling	0.538462	10	3	
12	org.axonframework.eventhandling.replay	org.axonframework.eventhandling	0.454545	8	3	[Re
13	org.axonframework.queryhandling.registration	org.axonframework.queryhandling	0.428571	5	2	
14	org.axonframework.serialization.upcasting.event	org.axonframework.eventhandling	0.333333	6	3	
15	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.eventsourcing.eventstore.jdbc...	0.317073	27	14	[J
16	org.axonframework.messaging	org.axonframework.serialization	0.300000	13	7	
17	org.axonframework.eventhandling	org.axonframework.eventhandling.tokenstore	0.230769	8	5	
18	org.axonframework.messaging.annotation	org.axonframework.messaging.interceptors	0.200000	3	2	
19	org.axonframework.modelling.command.inspection	org.axonframework.modelling.command	0.172414	17	12	
20	org.axonframework.modelling.saga	org.axonframework.modelling.saga.metamodel	0.142857	4	3	[An
21	org.axonframework.commandhandling.distributed....	org.axonframework.commandhandling.distributed	0.076923	7	6	

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	numberFo
0	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryResponseMessage<- ConvertingResponseMessage	0.875000	
1	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	StreamingQueryMessage->ResponseType	0.875000	
2	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericQueryMessage->ResponseType	0.875000	
3	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	DefaultQueryGateway->ResponseType	0.875000	
4	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericStreamingQueryMessage-> PublisherResponse...	0.875000	
5	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericStreamingQueryMessage->ResponseType	0.875000	
6	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SubscriptionQueryMessage->ResponseType	0.875000	
7	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryGateway->ResponseType	0.875000	
8	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryGateway->ResponseTypes	0.875000	
9	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter-> PublisherResponseType	0.875000	
10	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->OptionalResponseType	0.875000	
11	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->MultipleInstancesRes...	0.875000	
12	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->ResponseType	0.875000	
13	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryMessage->ResponseType	0.875000	
14	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QuerySubscription->ResponseType	0.875000	
15	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericSubscriptionQueryMessage->ResponseType	0.875000	
16	org.axonframework.eventhandling	org.axonframework.tracing	EventMessage<-NestingSpanFactory	0.857143	
17	org.axonframework.eventhandling	org.axonframework.tracing	SubscribingEventProcessor\$Builder->SpanFactory	0.857143	
18	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor->SpanFactory	0.857143	
19	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor->Span	0.857143	
20	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor\$Builder->SpanFactory	0.857143	
21	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor\$Builder->NoOpSpanFactory	0.857143	
22	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor\$Builder->SpanFactory	0.857143	
23	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus->SpanFactory	0.857143	
24	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus->Span	0.857143	
25	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor->SpanFactory	0.857143	
26	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor->Span	0.857143	
27	org.axonframework.eventhandling	org.axonframework.tracing	SimpleEventBus\$Builder->SpanFactory	0.857143	
28	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus\$Builder->NoOpSpanFactory	0.857143	
29	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus\$Builder->SpanFactory	0.857143	
30	org.axonframework.eventhandling	org.axonframework.messaging	DomainEventMessage<-Headers	0.853659	
31	org.axonframework.eventhandling	org.axonframework.messaging	EventMessage<-Headers	0.853659	
32	org.axonframework.eventhandling	org.axonframework.messaging	TrackingToken<-StreamableMessageSource	0.853659	
33	org.axonframework.eventhandling	org.axonframework.messaging	StreamingEventProcessor-> StreamableMessageSource	0.853659	
34	org.axonframework.eventhandling	org.axonframework.messaging	GenericTrackedDomainEventMessage->Message	0.853659	
35	org.axonframework.eventhandling	org.axonframework.messaging	SubscribingEventProcessor-> SubscribableMessage...	0.853659	
36	org.axonframework.eventhandling	org.axonframework.messaging	SubscribingEventProcessor\$Builder->Subscriabl...	0.853659	
37	org.axonframework.eventhandling	org.axonframework.messaging	TrackingTokenParameterResolverFactory\$Tracking...	0.853659	
38	org.axonframework.eventhandling	org.axonframework.messaging	MultiStreamableMessageSource-> StreamableMessag...	0.853659	
39	org.axonframework.eventhandling	org.axonframework.messaging	DomainEventMessage->Message	0.853659	
40	org.axonframework.eventhandling	org.axonframework.messaging	EventMessage->Message	0.853659	
41	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->MetaData	0.853659	
42	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->MessageDecorator	0.853659	
43	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->Message	0.853659	
44	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->GenericMessage	0.853659	
45	org.axonframework.eventhandling	org.axonframework.messaging	EventProcessor->MessageHandlerInterceptor	0.853659	
46	org.axonframework.eventhandling	org.axonframework.messaging	EventProcessor-> MessageHandlerInterceptorSupport	0.853659	
47	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->Message	0.853659	
48	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor-> StreamableMessageSource	0.853659	
49	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->InterceptorChain	0.853659	

	packageName	dependentPackageName	dependency	forwardToBackwardBalance	numberFo
50	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor\$Builder->StreamableMess...	0.853659	
51	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessorConfiguration->Streamabl...	0.853659	
52	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventBus->MessageDispatchInterceptor	0.853659	
53	org.axonframework.eventhandling	org.axonframework.messaging	ConcludesBatchParameterResolverFactory->Message	0.853659	
54	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->MessageHandlerInterceptor	0.853659	
55	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->ResultMessage	0.853659	
56	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->DefaultInterceptorChain	0.853659	
57	org.axonframework.eventhandling	org.axonframework.messaging	GenericTrackedEventMessage->Message	0.853659	
58	org.axonframework.eventhandling	org.axonframework.messaging	EventBus->SubscribableMessageSource	0.853659	
59	org.axonframework.eventhandling	org.axonframework.messaging	EventBus->MessageDispatchInterceptorSupport	0.853659	

## 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	18
1	org.axonframework.eventhandling.DomainEventMes...	10	[getSequenceNumber]	1	9
2	org.axonframework.eventhandling.EventMessage	9	[getIdentifier, getTimestamp]	2	8
3	org.axonframework.eventhandling.EventMessage	9	[getIdentifier]	1	8
4	org.axonframework.eventhandling.TrackedEventMe...	10	[trackingToken]	1	7
5	org.axonframework.messaging.ResultMessage	9	[isExceptional, exceptionResult]	2	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	[getSequenceNumber, getAggregateIdentifier, ge...	3	4
12	org.axonframework.eventhandling.DomainEventMes...	10	[getAggregateIdentifier]	1	4
13	org.axonframework.eventhandling.DomainEventMes...	10	[getType]	1	4
14	org.axonframework.eventhandling.GenericEventMe...	10	[asEventMessage]	1	4
15	org.axonframework.common.transaction.NoTransac...	4	[instance]	1	4
16	org.axonframework.eventhandling.ReplayToken	13	[isReplay]	1	3
17	org.axonframework.modelling.command.inspection...	13	[type]	1	3
18	org.axonframework.eventhandling.DomainEventMes...	11	[getSequenceNumber, getAggregateIdentifier, ge...	3	3
19	org.axonframework.eventhandling.DomainEventMes...	10	[getSequenceNumber, getAggregateIdentifier]	2	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...	36
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.Metadata	Metadata	[Type, File, Java, ByteCode, Class]	30
5	org.axonframework.messaging.unitofwork.UnitOfWork	UnitOfWork	[Type, File, Java, ByteCode, GenericDeclaratio...	29
6	org.axonframework.serialization.Serializer	Serializer	[Type, File, Java, ByteCode, Interface]	26
7	org.axonframework.common.Assert	Assert	[Type, File, Java, ByteCode, Class]	25
8	org.axonframework.common.transaction.TransactionManager	TransactionManager	[Type, File, Java, ByteCode, Interface]	23
9	org.axonframework.serialization.SerializedObject	SerializedObject	[Type, File, Java, ByteCode, GenericDeclaratio...	22
10	org.axonframework.messaging.unitofwork.CurrentUnitOfWork	CurrentUnitOfWork	[Type, File, Java, ByteCode, Class]	21
11	org.axonframework.serialization.SerializedType	SerializedType	[Type, File, Java, ByteCode, Interface]	21
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.messaging.MessageDispatchInterceptor	MessageDispatchInterceptor	[Type, File, Java, ByteCode, GenericDeclaratio...	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.common.transaction, org.axo...
1	axon-test-4.7.5	axon-messaging-4.7.5	10	61	0.163934	[org.axonframework.messaging, org.axonframewor...
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.inspectio...
4	axon-test-4.7.5	axon-eventsourcing-4.7.5	2	9	0.222222	[org.axonframework.eventsourcing, org.axonfram...
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.lock, org.axonframew...
7	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	20	61	0.327869	[org.axonframework.common, org.axonframework.m...
8	axon-test-4.7.5	axon-modelling-4.7.5	4	10	0.400000	[org.axonframework.modelling.command, org.axon...
9	axon-configuration-4.7.5	axon-eventsourcing-4.7.5	4	9	0.444444	[org.axonframework.eventsourcing.snapshotting,...
10	axon-configuration-4.7.5	axon-messaging-4.7.5	34	61	0.557377	[org.axonframework.messaging.correlation, org....
11	axon-modelling-4.7.5	axon-modelling-4.7.5	6	10	0.600000	[org.axonframework.modelling.saga, org.axonfra...
12	axon-configuration-4.7.5	axon-modelling-4.7.5	6	10	0.600000	[org.axonframework.modelling.saga.repository.j...
13	axon-test-4.7.5	axon-test-4.7.5	5	8	0.625000	[org.axonframework.test.matchers, org.axonfram...
14	axon-messaging-4.7.5	axon-messaging-4.7.5	40	61	0.655738	[org.axonframework.deadline, org.axonframework...
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-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.snapshotting	org.axonframework.eventhandling	1	
1	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.saga.metamodel	org.axonframework.eventhandling	1	
2	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	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-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.eventhandling	2	
6	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.eventscheduler	org.axonframework.eventhandling	2	
7	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.command.legacyjpa	org.axonframework.eventhandling	2	
8	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.command	org.axonframework.eventhandling	2	
9	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore	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-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test	org.axonframework.messaging	1	
13	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.jpa	org.axonframework.serialization	1	
14	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.legacyjpa	org.axonframework.serialization	1	
15	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.eventstore.jdbc	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-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.commandhandling	1	
19	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	org.axonframework.commandhandling	1	