

Internal Dependencies

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

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 as an overview

	packageName	dependentPackageName	forwardToBackwardBalance	numberForward	numb
0	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	0.882353	16	
1	org.axonframework.eventhandling	org.axonframework.tracing	0.857143	13	
2	org.axonframework.eventhandling	org.axonframework.messaging	0.853659	38	
3	org.axonframework.eventhandling	org.axonframework.messaging.annotation	0.840000	23	
4	org.axonframework.queryhandling	org.axonframework.tracing	0.800000	9	
5	org.axonframework.eventsourcing	org.axonframework.eventsourcing.eventstore	0.777778	16	
6	org.axonframework.deadline	org.axonframework.tracing	0.750000	7	
7	org.axonframework.commandhandling.callbacks	org.axonframework.commandhandling	0.733333	13	
8	org.axonframework.commandhandling	org.axonframework.tracing	0.666667	5	
9	org.axonframework.eventhandling	org.axonframework.serialization	0.647059	14	
10	org.axonframework.messaging.unitofwork	org.axonframework.messaging	0.647059	14	
11	org.axonframework.eventhandling.async	org.axonframework.eventhandling	0.538462	10	
12	org.axonframework.eventhandling.replay	org.axonframework.eventhandling	0.454545	8	
13	org.axonframework.serialization.upcasting.event	org.axonframework.eventhandling	0.333333	6	
14	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.eventsourcing.eventstore.jdbc...	0.317073	27	
15	org.axonframework.modelling.command.inspection	org.axonframework.modelling.command	0.250000	20	
16	org.axonframework.queryhandling.registration	org.axonframework.queryhandling	0.250000	5	
17	org.axonframework.messaging	org.axonframework.serialization	0.238095	13	
18	org.axonframework.eventhandling	org.axonframework.eventhandling.tokenstore	0.230769	8	
19	org.axonframework.messaging.annotation	org.axonframework.messaging.interceptors	0.200000	3	
20	org.axonframework.modelling.saga	org.axonframework.modelling.saga.metamodel	0.142857	4	
21	org.axonframework.commandhandling.distributed....	org.axonframework.commandhandling.distributed	0.076923	7	

Table 3

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

	packageName	dependentPackageName	dependency	forwardToBackward
0	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryResponseMessage<- ConvertingResponseMessage	0
1	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	StreamingQueryMessage->ResponseType	0
2	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	DefaultQueryGateway->ResponseType	0
3	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericStreamingQueryMessage->PublisherRespons...	0
4	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericStreamingQueryMessage->ResponseType	0
5	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SubscriptionQueryMessage->ResponseType	0
6	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericQueryMessage->ResponseType	0
7	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	GenericSubscriptionQueryMessage->ResponseType	0
8	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->ResponseType	0
9	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->MultipleInstancesRes...	0
10	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->OptionalResponseType	0
11	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryUpdateEmitter->PublisherResponseType	0
12	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	SimpleQueryBus->ResponseType	0
13	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryMessage->ResponseType	0
14	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QuerySubscription->ResponseType	0
15	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryGateway->ResponseTypes	0
16	org.axonframework.queryhandling	org.axonframework.messaging.responsetypes	QueryGateway->ResponseType	0
17	org.axonframework.eventhandling	org.axonframework.tracing	EventMessage<-NestingSpanFactory	C
18	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor\$Builder->SpanFactory	C
19	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor\$Builder->NoOpSpanFactory	C
20	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor->SpanFactory	C
21	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor->Span	C
22	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus\$Builder->NoOpSpanFactory	C
23	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus\$Builder->SpanFactory	C
24	org.axonframework.eventhandling	org.axonframework.tracing	TrackingEventProcessor\$Builder->SpanFactory	C
25	org.axonframework.eventhandling	org.axonframework.tracing	SubscribingEventProcessor\$Builder->SpanFactory	C
26	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor->SpanFactory	C
27	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventProcessor->Span	C
28	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus->SpanFactory	C
29	org.axonframework.eventhandling	org.axonframework.tracing	AbstractEventBus->Span	C
30	org.axonframework.eventhandling	org.axonframework.tracing	SimpleEventBus\$Builder->SpanFactory	C
31	org.axonframework.eventhandling	org.axonframework.messaging	DomainEventMessage<-Headers	0
32	org.axonframework.eventhandling	org.axonframework.messaging	EventMessage<-Headers	0
33	org.axonframework.eventhandling	org.axonframework.messaging	TrackingToken<-StreamableMessageSource	0
34	org.axonframework.eventhandling	org.axonframework.messaging	TrackingTokenParameterResolverFactory\$Tracking...	0
35	org.axonframework.eventhandling	org.axonframework.messaging	MultiStreamableMessageSource\$IdentifiedStream...	0
36	org.axonframework.eventhandling	org.axonframework.messaging	ConcludesBatchParameterResolverFactory->Message	0
37	org.axonframework.eventhandling	org.axonframework.messaging	SubscribingEventProcessor->SubscribableMessage...	0
38	org.axonframework.eventhandling	org.axonframework.messaging	MultiStreamableMessageSource->StreamableMessag...	0
39	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->Message	0
40	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->StreamableMessageSource	0
41	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor->InterceptorChain	0
42	org.axonframework.eventhandling	org.axonframework.messaging	GenericDomainEventMessage->Message	0
43	org.axonframework.eventhandling	org.axonframework.messaging	GenericDomainEventMessage->GenericMessage	0
44	org.axonframework.eventhandling	org.axonframework.messaging	GenericDomainEventMessage->MetaData	0
45	org.axonframework.eventhandling	org.axonframework.messaging	ReplayToken->Message	0
46	org.axonframework.eventhandling	org.axonframework.messaging	EventMessageHandler->MessageHandler	0
47	org.axonframework.eventhandling	org.axonframework.messaging	EventMessageHandler->Message	0
48	org.axonframework.eventhandling	org.axonframework.messaging	SequenceNumberParameterResolverFactory\$Sequenc...	0
49	org.axonframework.eventhandling	org.axonframework.messaging	GenericTrackedDomainEventMessage->Message	0
50	org.axonframework.eventhandling	org.axonframework.messaging	DomainEventMessage->Message	0

	packageName	dependentPackageName	dependency	forwardToBackward
51	org.axonframework.eventhandling	org.axonframework.messaging	TrackingEventProcessor\$Builder->StreamableMess...	0
52	org.axonframework.eventhandling	org.axonframework.messaging	SubscribingEventProcessor\$Builder->Subscriabl...	0
53	org.axonframework.eventhandling	org.axonframework.messaging	StreamingEventProcessor->StreamableMessageSource	0
54	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->DefaultInterceptorChain	0
55	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->ResultMessage	0
56	org.axonframework.eventhandling	org.axonframework.messaging	AbstractEventProcessor->MessageHandlerInterceptor	0
57	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->GenericMessage	0
58	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->MessageDecorator	0
59	org.axonframework.eventhandling	org.axonframework.messaging	GenericEventMessage->MetaData	0

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 4

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

	fullDependentTypeName	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	[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	[getAggregateIdentifier, getType, getSequenceN...	3	5
6	org.axonframework.messaging.ResultMessage	9	[exceptionResult, isExceptional]	2	5
7	org.axonframework.commandhandling.GenericComma...	15	[asCommandResultMessage]	1	4
8	org.axonframework.commandhandling.GenericComma...	14	[asCommandResultMessage]	1	4
9	org.axonframework.eventhandling.TrackedEventMe...	12	[trackingToken]	1	4
10	org.axonframework.deadline.GenericDeadlineMessage	11	[asDeadlineMessage]	1	4
11	org.axonframework.deadline.DeadlineMessage	10	[getDeadlineName]	1	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.modelling.command.inspection...	13	[type]	1	3
17	org.axonframework.eventhandling.DomainEventMes...	11	[getAggregateIdentifier, getType, getSequenceN...	3	3
18	org.axonframework.eventhandling.DomainEventMes...	10	[getAggregateIdentifier, getSequenceNumber]	2	3
19	org.axonframework.eventhandling.GapAwareTracki...	10	[getGaps, withGapsTruncatedAt, getIndex, newIn...	5	3

Package Usage

Types that are used by multiple packages

Table 5

- 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.common.Assert	Assert	[Type, File, Java, ByteCode, Class]	26
7	org.axonframework.serialization.Serializer	Serializer	[Type, File, Java, ByteCode, Interface]	26
8	org.axonframework.common.transaction.Transaction...	TransactionManager	[Type, File, Java, ByteCode, Interface]	23
9	org.axonframework.serialization.SerializedObject	SerializedObject	[Type, File, Java, ByteCode, GenericDeclaratio...	22
10	org.axonframework.messaging.unitofwork.Current...	CurrentUnitOfWork	[Type, File, Java, ByteCode, Class]	21
11	org.axonframework.serialization.SerializedType	SerializedType	[Type, File, Java, ByteCode, Interface]	21
12	org.axonframework.common.AxonNonTransientExcep...	AxonNonTransientException	[Type, File, Java, ByteCode, Class]	18
13	org.axonframework.messaging.annotation.Paramet...	ParameterResolverFactory	[Type, File, Java, ByteCode, Interface]	18
14	org.axonframework.eventhandling.DomainEventMes...	DomainEventMessage	[Type, File, Java, ByteCode, GenericDeclaratio...	17
15	org.axonframework.eventhandling.TrackingToken	TrackingToken	[Type, File, Java, ByteCode, Interface]	17
16	org.axonframework.common.Registration	Registration	[Type, File, Java, ByteCode, Interface]	16
17	org.axonframework.eventhandling.GenericEventMe...	GenericEventMessage	[Type, File, Java, ByteCode, Class, GenericDec...	16
18	org.axonframework.common.ObjectUtils	ObjectUtils	[Type, File, Java, ByteCode, Class]	15
19	org.axonframework.messaging.MessageDispatchInt...	MessageDispatchInterceptor	[Type, File, Java, ByteCode, GenericDeclaratio...	15

Packages that are used by multiple artifacts

Table 6

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

	artifactName	dependentArtifactName	dependentPackages	dependentArtifactPackages	packageUsagePercentage	dependentFullQualified
0	axon-disruptor-4.7.5	axon-messaging-4.7.5	9	61	0.147541	[org.axonframework.cor
1	axon-test-4.7.5	axon-messaging-4.7.5	10	61	0.163934	[org.axonframev org.
2	axon-disruptor-4.7.5	axon-modelling-4.7.5	2	10	0.200000	[org.axonframework.mod
3	axon-eventsourcing-4.7.5	axon-modelling-4.7.5	2	10	0.200000	[org.axonframework.mod
4	axon-disruptor-4.7.5	axon-eventsourcing-4.7.5	2	9	0.222222	[org.axonframework.eventsourcing
5	axon-test-4.7.5	axon-eventsourcing-4.7.5	2	9	0.222222	[org.axonframework]
6	axon-modelling-4.7.5	axon-messaging-4.7.5	18	61	0.295082	[org.axonframework]
7	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	20	61	0.327869	[org.axonfram org.axc
8	axon-configuration-4.7.5	axon-eventsourcing-4.7.5	4	9	0.444444	[org.axonframework]
9	axon-test-4.7.5	axon-modelling-4.7.5	5	10	0.500000	[org.axonframework.modelling.sag
10	axon-configuration-4.7.5	axon-messaging-4.7.5	34	61	0.557377	[org.axonframework.eventhandling
11	axon-modelling-4.7.5	axon-modelling-4.7.5	6	10	0.600000	[org.axonframework.modelling.sag
12	axon-configuration-4.7.5	axon-modelling-4.7.5	6	10	0.600000	[org.axonframework.modelling.sag
13	axon-test-4.7.5	axon-test-4.7.5	5	8	0.625000	[org.axonframework]
14	axon-messaging-4.7.5	axon-messaging-4.7.5	40	61	0.655738	[org.axonframework]
15	axon-eventsourcing-4.7.5	axon-eventsourcing-4.7.5	7	9	0.777778	[org.axonframework.eventsourcing]
16	axon-configuration-4.7.5	axon-disruptor-4.7.5	1	1	1.000000	[org.axonframework.disruptor.cor

Packages that are used by multiple artifacts

Table 7

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

	artifactName	dependentArtifactName	packageName	dependentPackage.fqn	dependentTypes	dependencies
0	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	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-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.snapshotting	org.axonframework.eventhandling	1	
3	axon-eventsourcing-4.7.5	axon-modelling-4.7.5	org.axonframework.eventsourcing.eventstore.jdbc	org.axonframework.modelling.command	1	
4	axon-eventsourcing-4.7.5	axon-modelling-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.modelling.command	1	
5	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.command.legacyjpa	org.axonframework.eventhandling	2	
6	axon-modelling-4.7.5	axon-messaging-4.7.5	org.axonframework.modelling.command	org.axonframework.eventhandling	2	
7	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	org.axonframework.eventhandling	2	
8	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.eventscheduler	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	org.axonframework.messaging	1	
11	axon-test-4.7.5	axon-messaging-4.7.5	org.axonframework.test.matchers	org.axonframework.messaging	1	
12	axon-eventsourcing-4.7.5	axon-messaging-4.7.5	org.axonframework.eventsourcing.conflictresolution	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.jdbc	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	