

# **.CQ**

# **analysis report**

**Project name:   Comp.Horizon**

**Analysis date:   2013-06-20 14:47**

**User:            John Doe**

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# 0 Introduction

## *About this report*

This report analyzes some aspects of the maintainability of the software project under question. The maintainability of a project largely determines the expenses during its maintenance phase and also its overall lifetime. And since maintenance costs make up by far the biggest single cost item within a software project's budget (50-90%, usually around 3/4), relatively small improvements in the system's maintainability can result in huge cost savings.

Some basic informations about the methods of analysis and the structure of this document are given below. More detailed information about the here used methodology can be found in the Appendix section of this document and/or on [www.dotcq.com](http://www.dotcq.com).

## *Two parts of analysis*

This report makes an analysis of the project under question basically in two ways:

The first part is intended to assess the overall maintainability of the system, and also to concretely pinpoint problematic source code locations, allowing to directly act upon these locations. It analyzes the source code (precisely: the C# part thereof) and sums up the results to some basic scores. Also, various lists are compiled that point to the most critical source code locations.

The second part of the analysis involves custom, user-defined data and is statistical in nature. It is aimed to gain deeper insights in the software development process and shows how the maintainability of the system's source code may influence mission-critical figures.

### Part 1: Computing a maintainability rating from source code

First, some metrics are measured on the project's source code. These metrics are:

- **System Volume:** The larger a system, the more effort it takes to maintain it.
- **Method Complexity:** Simple methods are easier to comprehend and test than complex ones.
- **Duplication (Code cloning):** Duplicated code has to be maintained in all places where it occurs.
- **Method Size:** Methods should be kept small to be focused and easier to understand.

The results then are mapped to the following subcharacteristics of the ISO/IEC 9126 software maintainability standard:

- **Analysability:** Describes how easy or difficult it is to diagnose the system for deficiencies or to identify the parts that need to be modified.
- **Changeability:** Describes how easy or difficult it is to make adaptations to the system.
- **Testability:** Describes how easy or difficult it is to test the system after modification.

The score is given as an integral number between -2 (very bad) and +2 (very good). Finally, by combining the subscores, the system's overall maintainability rating is computed (also resulting in a rating between -2 and +2, this time as a floating-point number).

### Part 2: Correlating the maintainability rating with custom data

In a second step, the system's maintainability rating is mapped to a number of custom-defined data series, that were entered for this project on the .CQ website (e.g. sales figures or 'number of

issues', or any other numerical data). A statistical correlation is computed for each data series that expresses the relationship between this series of figures and the system's overall maintainability rating.

### ***Three main sections***

The results of the described analysis are presented in the three main sections of this document (chapters 2 through 4):

#### **Source Code Metrics**

This section and its subsections present the results and ratings of the first part of the analysis.

#### **System Summary**

This section contains information that applies to the system level: An overall maintainability rating, historical trending data, and the results of the statistical part of the performed analysis.

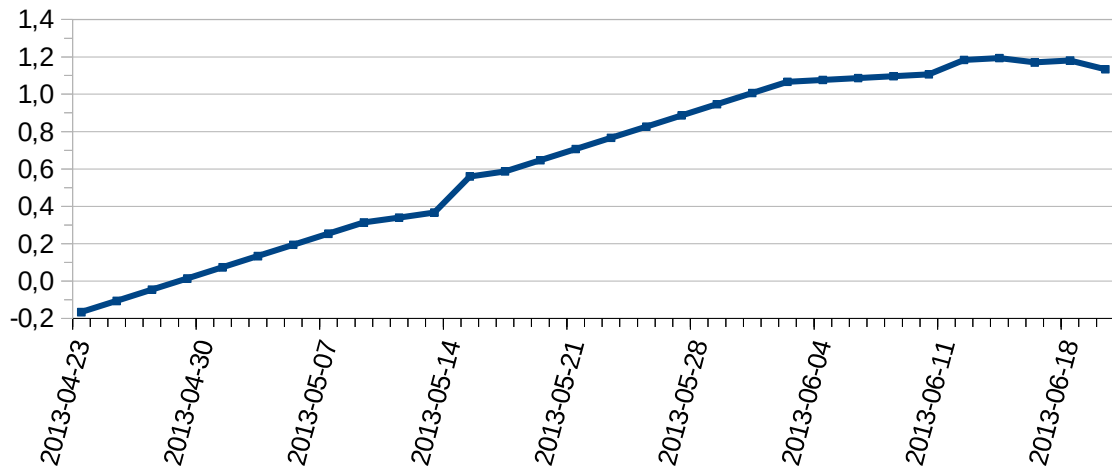
#### **Code Locations**

This section contains various tables that list the locations of source code which are found to be problematic regarding one or more of the above metrics.

# 1 Summary

## 1.1 Maintainability

The overall system maintainability rating is 0.9, with rising long-term tendency and falling short-term tendency. The following chart shows the historical trend of the last 30 analysis runs:



## 1.2 Custom Data

Two custom data series are defined:

- **Sales (USD):** Overall sales figures of the software development department in USD. This measure shows a strong correlation with the overall system maintainability.
- **# Bugs:** The number of new bugs that were reported during a 2-week period. This measure shows a strong negative correlation with the overall system maintainability.

The following chart visualizes the correlation between the data series and overall system maintainability rating:



## 2 Source Code Metrics

### 2.1 System Volume

**The rating for the metric 'System Volume' is 0**

The Comp.Horizon project has a total of **70,101 lines of C# source code** (SLOC).

This volume is roughly equivalent to a work effort of 217 person-months, or 18 person-years. Based on the project settings, this corresponds to a monetary value of USD 1,866,200.

4,544 lines of code comments were detected, resulting in a code/comment ratio of 6.1%.

### 2.2 Complexity

**The rating for the metric 'Method Complexity' is 2**

Comp.Horizon's risk profile with respect to method complexity is as follows:

<b>Risk category</b>	<b># methods</b>	<b># code lines</b>	<b>Ratio (%)</b>
Untestable, very high risk	0	-	-
Complex, high risk	1	46	> 0.1
More complex, moderate risk	22	687	0.1
Simple, without much risk	7290	42694	60.9

**Note:** Details and definitions about the applied metrics, calculations and methodology can be found in the appendix section of this document and/or on [www.dotcq.com](http://www.dotcq.com).

### 2.3 Duplication

**The rating for the metric 'Duplication (Code cloning)' is 0**

A total of **214 clone instances** were detected, involving **5,743 code lines** in 82 files. The system's duplication density is **6.4%**.

## 2.4 Method Size

The rating for the metric 'Method Size' is 1

Comp.Horizon's risk profile with respect to method size is as follows:

Risk category	# methods	# code lines	Ratio (%)
very large, very high risk	0	-	-
large, high risk	7	416	0.6
Moderate, low risk	790	10,411	14.9
small, no risk	6,516	32,600	46.5

**Note:** Details and definitions about the applied metrics, calculations and methodology can be found in the appendix section of this document and/or on [www.dotcq.com](http://www.dotcq.com).

## 3 System summary

### 3.1 Metrics

#### The overall system maintainability rating is 0.9

Based on the above ratings of individual metrics, Comp.Horizon's maintainability profile for the dimensions analysability, changeability, and testability is as follows:

Maintainability Dimension	System volume	Complexity	Duplication	Method size	System Rating
Analysability	0		0	1	<b>0.3</b>
Changeability		2	0		<b>1.0</b>
Testability		2		1	<b>1.5</b>

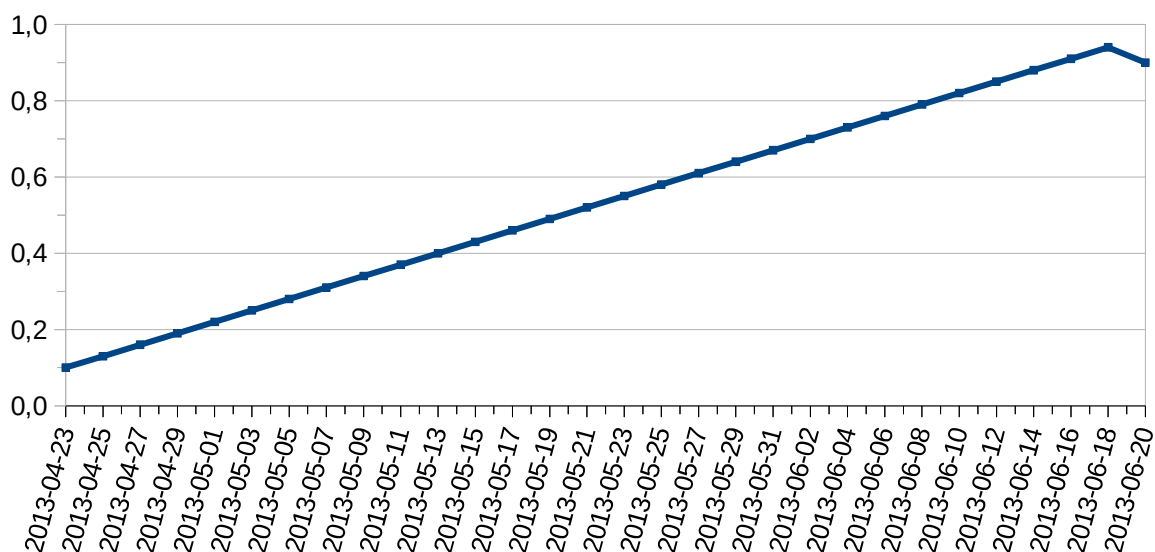
**0.9**

**Note:** Details and definitions about the applied metrics, calculations and methodology can be found in the appendix section of this document and/or on [www.dotcq.com](http://www.dotcq.com).

### 3.2 Historical

This section visualizes the historical trends in the rated maintainability dimensions and the overall system maintainability rating, based on previous analysis results for Comp.Horizon. These data are included in the appendix section of this document (5.1.2).

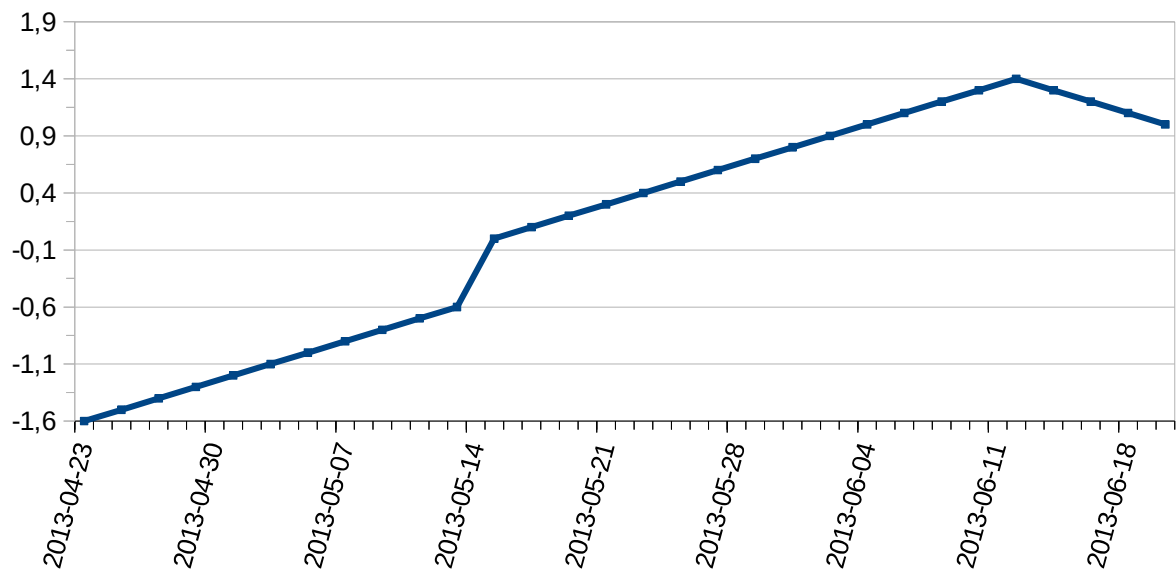
#### 3.2.1 Analysability



Project analysability rating by date.

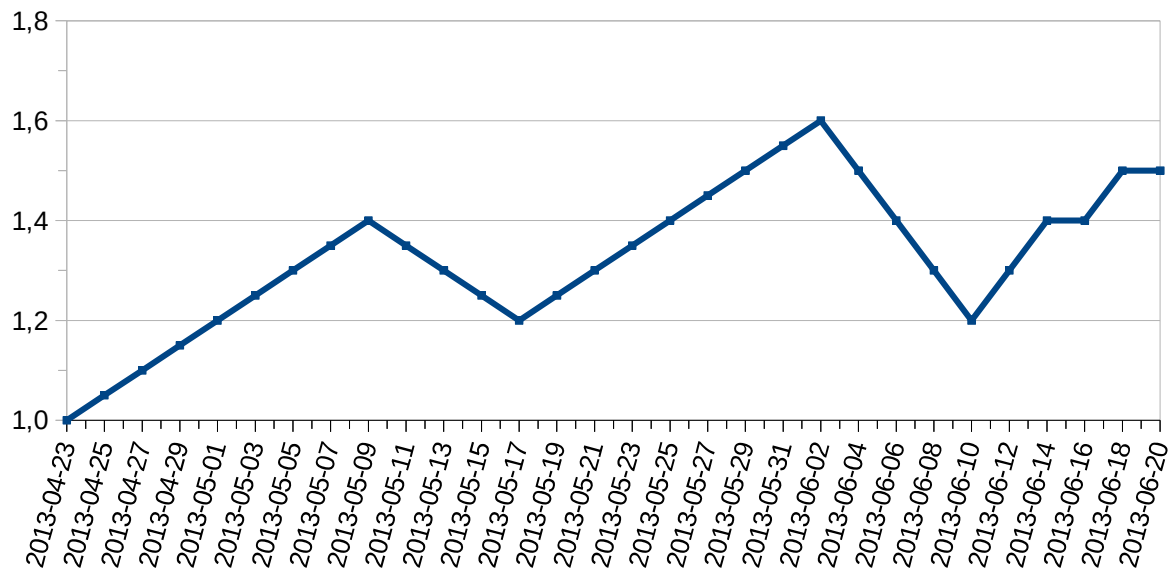


### 3.2.2 Changeability



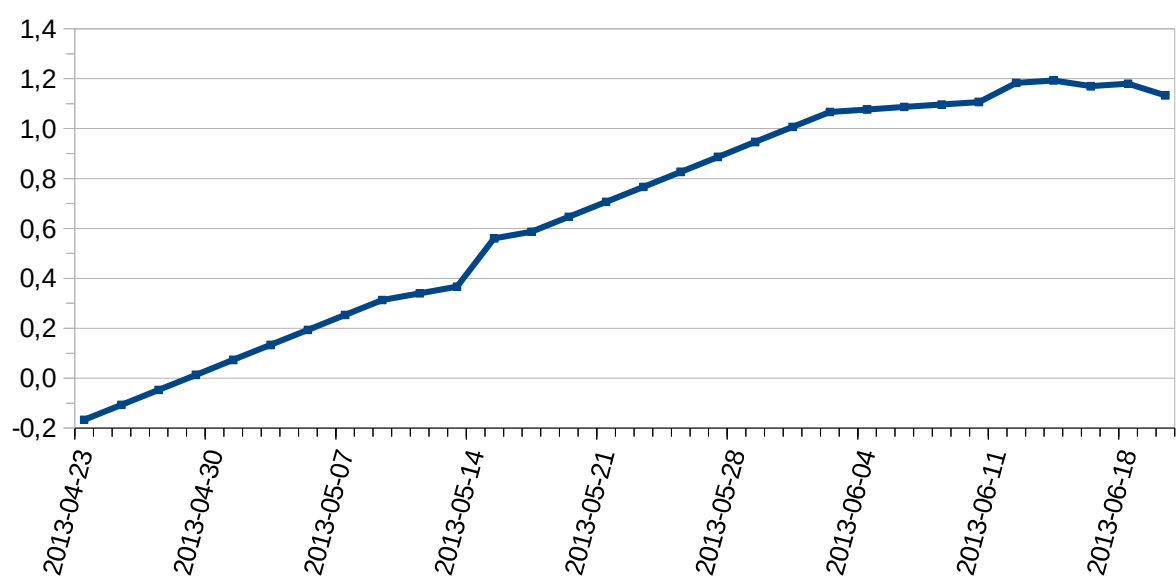
Project changeability rating by date.

### 3.2.3 Testability



Project testability rating by date.

3.2.4 Overall system maintainability



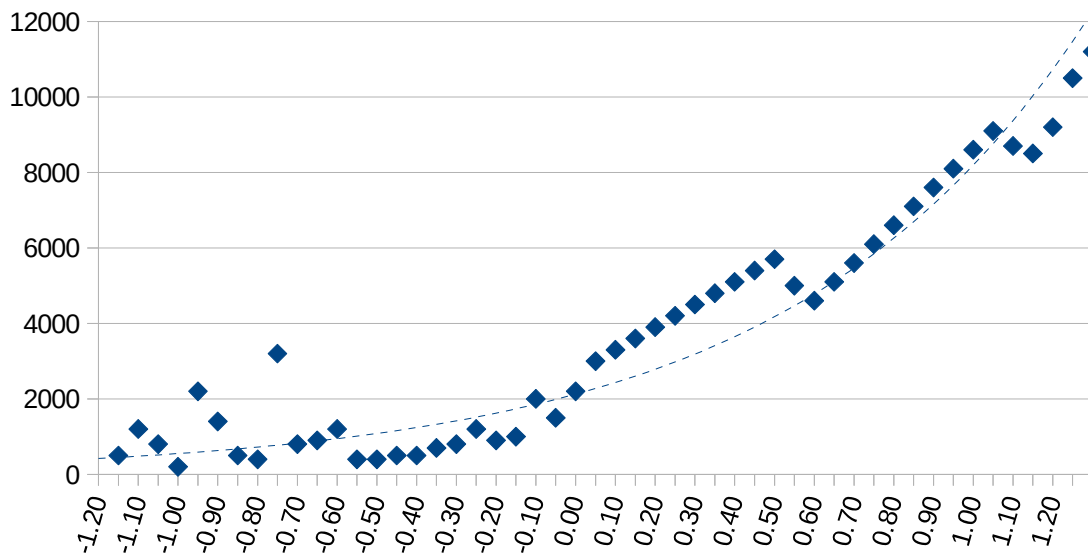
Overall system maintainability rating by date.

### 3.3 Custom Data

This section visualizes the data-points within Comp.Horizon's user-defined data and their distribution, based on the user-defined data series and the entered data for these series (Y axis). Each data-point is paired with the corresponding overall maintainability rating (X axis). Based on the so obtained data-pairs, the statistical correlation is computed.

#### 3.3.1 Sales (USD)

Description: Overall sales figures of the software development department in USD.

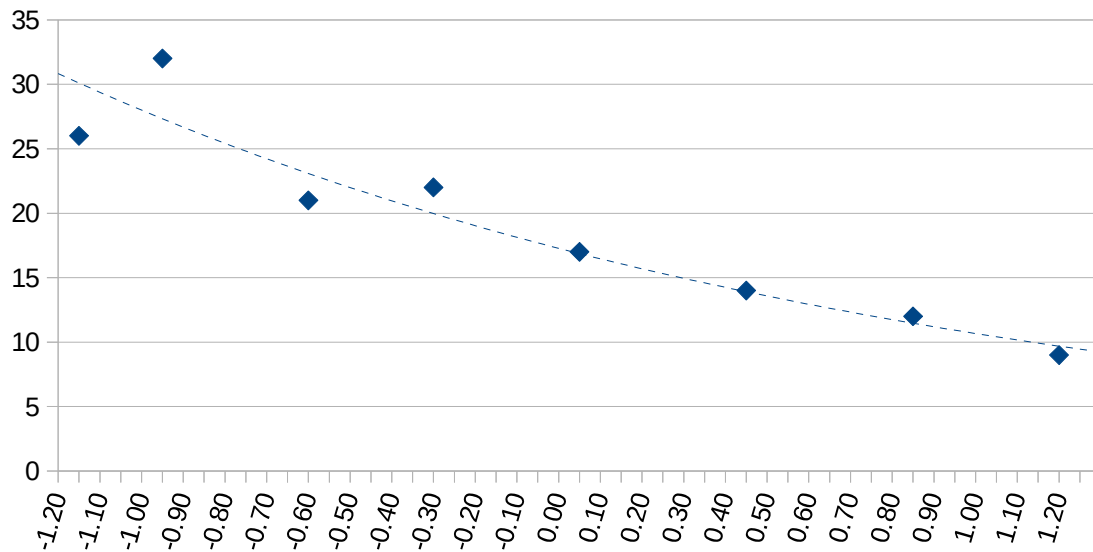


Sales (USD) by system maintainability rating.

The statistical correlation between the system maintainability rating and the data series 'Sales (USD)' has a positive direction, is strong and highly significant ( $\rho = 0.911$ ,  $\alpha < 0.01$ ). It is based on a high number of discrete data-points ( $n = 50$ ).

### 3.3.2 # Bugs

Description: The number of new bugs that were reported during a 2-week period.



# Bugs by system maintainability rating.

The statistical correlation between the system maintainability rating and the data series '# Bugs' has a negative direction, is strong and highly significant ( $\rho = -0.952$ ,  $\alpha < 0.01$ ). It is based on a low number of discrete data-points ( $n = 8$ ).

## 4 Code Locations

### 4.1 Top 50 Methods with highest complexity (CC)

Method	Location	CC
ProcessClass (ClassMapping)	XmlClassWriter.cs;25	21
WriteBaseCollectionAttributes,XmlElement (CollectionMapping)	CollectionAttributeWriter.cs;65	19
AlterModel (ClassMappingBase)	AutoMapping.cs;39	17
GetClassMapping()	ClassMap.cs;614	17
ProcessSubclass (SubclassMapping)	XmlSubclassWriter.cs;26	17
IsIntegralType (Type)	GeneratorBuilder.cs;46	16
Create()	IfxSQLIConnectionStringBuilder.cs;185	15
ProcessManyToOne (ManyToOneMapping)	XmlManyToOneWriter.cs;24	15
CompileMappings()	AutoPersistenceModel.cs;141	13
Create()	IfxDRDAConnectionStringBuilder.cs;199	13
Resolve (Member)	MemberAccessResolver.cs;5	13
ProcessColumn (ColumnMapping)	XmlColumnWriter.cs;18	12
Equals (MappedMembers)	MappedMembers.cs;231	11
AcceptVisitor (IMappingModelVisitor)	CollectionMapping.cs;34	11
ProcessOneToOne (OneToOneMapping)	XmlOneToOneWriter.cs;18	11
MapInheritanceTree,Type,ClassMappingBase (IList<Member>)	AutoMapper.cs;52	10

Method	Location	CC
GetSubclassMapping (SubclassType)	SubclassMap.cs;284	10
AcceptVisitor (IMappingModelVisitor)	MappedMembers.cs;188	10
GetHashCode ()	MappedMembers.cs;254	10
ProcessAny (AnyMapping)	XmlAnyWriter.cs;24	10
ProcessManyToMany (ManyToManyMapping)	XmlManyToManyWriter.cs;26	10
ProcessProperty (PropertyMapping)	XmlPropertyWriter.cs;24	10
EditDistance, string (string)	StringLikeness.cs;15	10
ShouldMap (Type)	AutoPersistenceModel.cs;239	9
GetCollectionMapping ()	ManyToManyPart.cs;343	9
ProcessHibernateMapping (HibernateMapping)	XmlHibernateMappingWriter.cs;28	9
ProcessKeyManyToOne (KeyManyToOneMapping)	XmlKeyManyToOneWriter.cs;25	9
AssertGenericListMatches, IEnumerable (IEnumerable<TListElement>)	List.cs;74	9
GetInequalityComparisonMessage (object)	Property.cs;86	9
FindMapping (Type)	AutoPersistenceModel.cs;274	8
GetAnyMapping ()	AnyPart.cs;157	8
CreateComponentMapping ()	ComponentPartBase.cs;147	8
GetSubclassMapping ()	JoinedSubClassPart.cs;137	8
GetJoinMapping ()	JoinPart.cs;138	8
GetSubclassMapping ()	SubClassPart.cs;33	8
GetCollectionMapping ()	ToManyBase.cs;723	8
ProcessJoin (JoinMapping)	XmlJoinWriter.cs;26	8

Method	Location	CC
Sort (XmlNode)	BaseXmlNodeSorter.cs;13	8
Convert<T> (BinaryExpression)	ExpressionToSql.cs;108	8
TryMapProperty, ClassMappingBase, Member (IList<Member>)	AutoMapper.cs;162	7
Add, Type (MissingConstructor)	DefaultConventionFinder.cs;129	7
GuessNamingStrategy (string)	Naming.cs;27	7
GetPropertyMapping ()	PropertyPart.cs;319	7
AcceptVisitor (IMappingModelVisitor)	ClassMapping.cs;69	7
ProcessCollection (CollectionMapping)	XmlCollectionWriter.cs;29	7
ProcessKey (KeyMapping)	XmlKeyWriter.cs;24	7
SortChildren (XmlNode)	XmlClasslikeNodeSorter.cs;60	7
Convert<T> (Expression<Func<T, bool>>)	ExpressionToSql.cs;31	7
SortByDistanceFrom, Type (IEnumerable<IIIndeterminateSubclassMappingProvider>)	SeparateSubclassVisitor.cs;85	7
ShouldMap (Member)	HasManyToManyStep.cs;22	6

## 4.2 Top 50 clone sets

# lines	# instances	Instance length (low/high/avg.)	Instance locations
422	2	211/211/211	ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;37 (211) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;36 (211)
422	2	211/211/211	ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;37 (211) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;36 (211)
332	4	83/83/83	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;36 (83) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;36 (83)
332	4	83/83/83	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;36 (83) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;36 (83)
332	4	83/83/83	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;36 (83) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;36 (83)
332	4	83/83/83	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;37 (83) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;36 (83) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;36 (83)
326	3	105/116/108,7	MappingModel/Output/XmlBagWriterTester.cs;70 (105) MappingModel/Output/XmlMapWriterTester.cs;75 (116) MappingModel/Output/XmlSetWriterTester.cs;70 (105)
326	3	105/116/108,7	MappingModel/Output/XmlBagWriterTester.cs;70 (105) MappingModel/Output/XmlMapWriterTester.cs;75 (116) MappingModel/Output/XmlSetWriterTester.cs;70 (105)



# lines	# instances	Instance length (low/high/avg.)	Instance locations
326	3	105/116/108,7	MappingModel/Output/XmlBagWriterTester.cs;70 (105) MappingModel/Output/XmlMapWriterTester.cs;75 (116) MappingModel/Output/XmlSetWriterTester.cs;70 (105)
311	5	60/66/62,2	MappingModel/Output/XmlBagWriterTester.cs;70 (60) MappingModel/Output/XmlMapWriterTester.cs;75 (66) MappingModel/Output/XmlListWriterTester.cs;75 (65) MappingModel/Output/XmlArrayWriterTester.cs;70 (60) MappingModel/Output/XmlSetWriterTester.cs;70 (60)
311	5	60/66/62,2	MappingModel/Output/XmlBagWriterTester.cs;70 (60) MappingModel/Output/XmlMapWriterTester.cs;75 (66) MappingModel/Output/XmlListWriterTester.cs;75 (65) MappingModel/Output/XmlArrayWriterTester.cs;70 (60) MappingModel/Output/XmlSetWriterTester.cs;70 (60)
311	5	60/66/62,2	MappingModel/Output/XmlBagWriterTester.cs;70 (60) MappingModel/Output/XmlMapWriterTester.cs;75 (66) MappingModel/Output/XmlListWriterTester.cs;75 (65) MappingModel/Output/XmlArrayWriterTester.cs;70 (60) MappingModel/Output/XmlSetWriterTester.cs;70 (60)
311	5	60/66/62,2	MappingModel/Output/XmlBagWriterTester.cs;70 (60) MappingModel/Output/XmlMapWriterTester.cs;75 (66) MappingModel/Output/XmlListWriterTester.cs;75 (65) MappingModel/Output/XmlArrayWriterTester.cs;70 (60) MappingModel/Output/XmlSetWriterTester.cs;70 (60)
311	5	60/66/62,2	MappingModel/Output/XmlBagWriterTester.cs;70 (60) MappingModel/Output/XmlMapWriterTester.cs;75 (66) MappingModel/Output/XmlListWriterTester.cs;75 (65) MappingModel/Output/XmlArrayWriterTester.cs;70 (60) MappingModel/Output/XmlSetWriterTester.cs;70 (60)
306	3	102/102/102	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;18 (102) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;17 (102) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;17 (102)

# lines	# instances	Instance length (low/high/avg.)	Instance locations
306	3	102/102/102	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;18 (102) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;17 (102) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;17 (102)
306	3	102/102/102	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;18 (102) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;17 (102) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;17 (102)
304	2	152/152/152	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;18 (152) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;17 (152)
304	2	152/152/152	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;18 (152) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;17 (152)
300	5	58/63/60	MappingModel/Output/XmlBagWriterTester.cs;11 (58) MappingModel/Output/XmlMapWriterTester.cs;11 (63) MappingModel/Output/XmlListWriterTester.cs;11 (63) MappingModel/Output/XmlArrayWriterTester.cs;11 (58) MappingModel/Output/XmlSetWriterTester.cs;11 (58)
300	5	58/63/60	MappingModel/Output/XmlBagWriterTester.cs;11 (58) MappingModel/Output/XmlMapWriterTester.cs;11 (63) MappingModel/Output/XmlListWriterTester.cs;11 (63) MappingModel/Output/XmlArrayWriterTester.cs;11 (58) MappingModel/Output/XmlSetWriterTester.cs;11 (58)
300	5	58/63/60	MappingModel/Output/XmlBagWriterTester.cs;11 (58) MappingModel/Output/XmlMapWriterTester.cs;11 (63) MappingModel/Output/XmlListWriterTester.cs;11 (63) MappingModel/Output/XmlArrayWriterTester.cs;11 (58) MappingModel/Output/XmlSetWriterTester.cs;11 (58)
300	5	58/63/60	MappingModel/Output/XmlBagWriterTester.cs;11 (58) MappingModel/Output/XmlMapWriterTester.cs;11 (63) MappingModel/Output/XmlListWriterTester.cs;11 (63) MappingModel/Output/XmlArrayWriterTester.cs;11 (58) MappingModel/Output/XmlSetWriterTester.cs;11 (58)

# lines	# instances	Instance length (low/high/avg.)	Instance locations
300	5	58/63/60	MappingModel/Output/XmlBagWriterTester.cs;11 (58) MappingModel/Output/XmlMapWriterTester.cs;11 (63) MappingModel/Output/XmlListWriterTester.cs;11 (63) MappingModel/Output/XmlArrayWriterTester.cs;11 (58) MappingModel/Output/XmlSetWriterTester.cs;11 (58)
288	3	96/96/96	ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;124 (96) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;123 (96) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;123 (96)
288	3	96/96/96	ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;124 (96) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;123 (96) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;123 (96)
288	3	96/96/96	ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;124 (96) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;123 (96) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;123 (96)
246	3	82/82/82	ConventionsTests/ApplyingToModel/HasManyCollectionConventionTests.cs;19 (82) ConventionsTests/ApplyingToModel/HasManyToManyCollectionConventionTests.cs;19 (82) ConventionsTests/ApplyingToModel/HasManyToManyConventionTests.cs;18 (82)
246	3	82/82/82	ConventionsTests/ApplyingToModel/HasManyCollectionConventionTests.cs;19 (82) ConventionsTests/ApplyingToModel/HasManyToManyCollectionConventionTests.cs;19 (82) ConventionsTests/ApplyingToModel/HasManyToManyConventionTests.cs;18 (82)
246	3	82/82/82	ConventionsTests/ApplyingToModel/HasManyCollectionConventionTests.cs;19 (82) ConventionsTests/ApplyingToModel/HasManyToManyCollectionConventionTests.cs;19 (82) ConventionsTests/ApplyingToModel/HasManyToManyConventionTests.cs;18 (82)
244	2	116/128/122	MappingModel/Output/XmlMapWriterTester.cs;75 (128) MappingModel/Output/XmlSetWriterTester.cs;70 (116)
244	2	116/128/122	MappingModel/Output/XmlMapWriterTester.cs;75 (128) MappingModel/Output/XmlSetWriterTester.cs;70 (116)
228	2	114/114/114	ConventionsTests/ApplyingToModel/HasManyToManyCollectionConventionTests.cs;19 (114) ConventionsTests/ApplyingToModel/HasManyToManyConventionTests.cs;18 (114)

# lines	# instances	Instance length (low/high/avg.)	Instance locations
228	2	114/114/114	ConventionsTests/ApplyingToModel/HasManyToManyCollectionConventionTests.cs;19 (114) ConventionsTests/ApplyingToModel/HasManyToManyConventionTests.cs;18 (114)
212	4	53/53/53	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;177 (53) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;167 (53) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;166 (53) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;166 (53)
212	4	53/53/53	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;177 (53) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;167 (53) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;166 (53) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;166 (53)
212	4	53/53/53	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;177 (53) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;167 (53) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;166 (53) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;166 (53)
212	4	53/53/53	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;177 (53) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;167 (53) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;166 (53) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;166 (53)
208	5	40/44/41,6	MappingModel/Output/XmlBagWriterTester.cs;135 (40) MappingModel/Output/XmlMapWriterTester.cs;147 (44) MappingModel/Output/XmlListWriterTester.cs;136 (44) MappingModel/Output/XmlArrayWriterTester.cs;126 (40) MappingModel/Output/XmlSetWriterTester.cs;135 (40)
208	5	40/44/41,6	MappingModel/Output/XmlBagWriterTester.cs;135 (40) MappingModel/Output/XmlMapWriterTester.cs;147 (44) MappingModel/Output/XmlListWriterTester.cs;136 (44) MappingModel/Output/XmlArrayWriterTester.cs;126 (40) MappingModel/Output/XmlSetWriterTester.cs;135 (40)

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208	5	40/44/41,6	MappingModel/Output/XmlBagWriterTester.cs;135 (40) MappingModel/Output/XmlMapWriterTester.cs;147 (44) MappingModel/Output/XmlListWriterTester.cs;136 (44) MappingModel/Output/XmlArrayWriterTester.cs;126 (40) MappingModel/Output/XmlSetWriterTester.cs;135 (40)
208	5	40/44/41,6	MappingModel/Output/XmlBagWriterTester.cs;135 (40) MappingModel/Output/XmlMapWriterTester.cs;147 (44) MappingModel/Output/XmlListWriterTester.cs;136 (44) MappingModel/Output/XmlArrayWriterTester.cs;126 (40) MappingModel/Output/XmlSetWriterTester.cs;135 (40)
208	5	40/44/41,6	MappingModel/Output/XmlBagWriterTester.cs;135 (40) MappingModel/Output/XmlMapWriterTester.cs;147 (44) MappingModel/Output/XmlListWriterTester.cs;136 (44) MappingModel/Output/XmlArrayWriterTester.cs;126 (40) MappingModel/Output/XmlSetWriterTester.cs;135 (40)
201	2	96/105/100,5	MappingModel/Output/XmlListWriterTester.cs;75 (105) MappingModel/Output/XmlArrayWriterTester.cs;70 (96)
201	2	96/105/100,5	MappingModel/Output/XmlListWriterTester.cs;75 (105) MappingModel/Output/XmlArrayWriterTester.cs;70 (96)
194	2	97/97/97	ConventionsTests/ApplyingToModel/VersionConventionTests.cs;48 (97) ConventionsTests/ApplyingToModel/IdConventionTests.cs;50 (97)
194	2	97/97/97	ConventionsTests/ApplyingToModel/VersionConventionTests.cs;48 (97) ConventionsTests/ApplyingToModel/IdConventionTests.cs;50 (97)
184	4	46/46/46	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;124 (46) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;124 (46) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;123 (46) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;123 (46)
184	4	46/46/46	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;124 (46) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;124 (46) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;123 (46) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;123 (46)

# lines	# instances	Instance length (low/high/avg.)	Instance locations
184	4	46/46/46	ConventionsTests/OverridingFluentInterface/HasManyToManyConventionTests.cs;124 (46) ConventionsTests/OverridingFluentInterface/HasManyConventionTests.cs;124 (46) ConventionsTests/OverridingFluentInterface/HasManyCollectionConventionTests.cs;123 (46) ConventionsTests/OverridingFluentInterface/HasManyToManyCollectionConventionTests.cs;123 (46)

### 4.3 Top 50 largest methods

Method	Location	SLOC
should_produce_simple_format()	DefaultOutputFormatterTests.cs;11	78
XmlWriterContainer()	XmlWriterContainer.cs;11	67
Create()	IfxSQLIConnectionStringBuilder.cs;185	59
GetInequalityComparisonMessage(object)	Property.cs;86	58
OutputAutomappings,StringBuilder(DiagnosticResults)	DefaultOutputFormatter.cs;26	52
MapInheritanceTree,Type,ClassMappingBase(IList<Member>)	AutoMapper.cs;52	51
Create()	IfxDRDAConnectionStringBuilder.cs;199	51
ProcessClass(ClassMapping)	XmlClassWriter.cs;25	46
GetSorting()	XmlClasslikeNodeSorter.cs;9	45
Main()	Program.cs;16	43
Main()	Program.cs;27	43
GetClassMapping()	ClassMap.cs;614	41
ProcessSubclass(SubclassMapping)	XmlSubclassWriter.cs;26	41
AlterModel(ClassMappingBase)	AutoMapping.cs;39	39
AssertGenericListMatches,IEnumerable(IEnumerable<TListElement>)	List.cs;74	38
Setup()	PersistenceSpecificationTester.cs;84	37
WriteBaseCollectionAttributes,XmlElement(CollectionMapping)	CollectionAttributeWriter.cs;65	37
OutputConventions,StringBuilder(DiagnosticResults)	DefaultOutputFormatter.cs;88	36

Method	Location	SLOC
OutputFluentMappings, StringBuilder (DiagnosticResults)	DefaultOutputFormatter.cs;131	36
EditDistance, string (string)	StringLikeness.cs;15	36
GetAnyMapping()	AnyPart.cs;157	34
GetSubclassMapping (SubclassType)	SubclassMap.cs;284	33
ProcessManyToOne (ManyToOneMapping)	XmlManyToOneWriter.cs;24	33
CompileMappings()	AutoPersistenceModel.cs;141	32
GetJoinMapping()	JoinPart.cs;138	31
Resolve (Member)	MemberAccessResolver.cs;5	31
ParentModelMapping()	ParentModelMapping.cs;11	29
Convert<T> (BinaryExpression)	ExpressionToSql.cs;108	29
ShouldMap (Type)	AutoPersistenceModel.cs;239	28
GetIdentityMapping()	IdentityPart.cs;272	28
GetCollectionMapping()	ToManyBase.cs;723	28
ProcessColumn (ColumnMapping)	XmlColumnWriter.cs;18	28
Sort (XmlNode)	BaseXmlNodeSorter.cs;13	27
AssertGenericListMatches, IEnumerable (IEnumerable<TListElement>)	ReferenceBag.cs;20	27
FindMapping (Type)	AutoPersistenceModel.cs;274	26
KeyProperty, Member, string (Action<KeyPropertyPart>)	CompositeIdentityPart.cs;70	26
GetCollectionMapping()	ManyToManyPart.cs;343	26
GetPropertyMapping()	PropertyPart.cs;319	25
ProcessCollection (CollectionMapping)	XmlCollectionWriter.cs;29	25



Method	Location	SLOC
ProcessOneToOne (OneToOneMapping)	XmlOneToOneWriter.cs;18	25
GeneratorClass_CanSpecifyHiLoWithWhere()	IdentityPartTester.cs;148	24
Map, ClassMappingBase (Member)	VersionStep.cs;25	24
ProcessProperty (PropertyMapping)	XmlPropertyWriter.cs;24	24
Add (Type)	PersistenceModel.cs;130	23
ProcessAny (AnyMapping)	XmlAnyWriter.cs;24	23
ProcessManyToMany (ManyToManyMapping)	XmlManyToManyWriter.cs;26	23
Passed_Transaction_Should_Apply_For_Reference_Saving()	PersistenceSpecificationTransactionTest.cs;63	22
GetSubclassMapping()	JoinedSubClassPart.cs;137	22
GetSubclassMapping()	SubClassPart.cs;33	22
ProcessHibernateMapping (HibernateMapping)	XmlHibernateMappingWriter.cs;28	22

#### 4.4 Top 50 methods with highest aggregated rating

Method	Location	CC	SLOC	# clone lines	Aggr. rating
ProcessClass (ClassMapping)	XmlClassWriter.cs;25	100	59	73.9	77.63
WriteBaseCollectionAttributes,XmlElement (CollectionMapping)	CollectionAttributeWriter.cs;65	90.5	47.4	81.1	73.00
Create ()	IfxSQLIConnectionStringBuilder.cs;185	71.4	75.6	71.2	72.73
ProcessSubclass (SubclassMapping)	XmlSubclassWriter.cs;26	81	52.6	70.7	68.10
GetInequalityComparisonMessage (object)	Property.cs;86	42.9	74.4	81	66.10
ProcessManyToOne (ManyToOneMapping)	XmlManyToOneWriter.cs;24	71.4	42.3	78.8	64.17
AlterModel (ClassMappingBase)	AutoMapping.cs;39	81	50	59	63.33
GetClassMapping ()	ClassMap.cs;614	81	52.6	41.5	58.37
Create ()	IfxDRDAConnectionStringBuilder.cs;199	61.9	65.4	47.1	58.13
ProcessOneToOne (OneToOneMapping)	XmlOneToOneWriter.cs;18	52.4	32.1	84	56.17
should_produce_simple_format ()	DefaultOutputFormatterTests.cs;11	4.8	100	55.1	53.30
XmlWriterContainer ()	XmlWriterContainer.cs;11	4.8	85.9	65.7	52.13
FindMapping (Type)	AutoPersistenceModel.cs;274	38.1	33.3	84.6	52.00
AcceptVisitor (IMappingModelVisitor)	CollectionMapping.cs;34	52.4	23.1	77.8	51.10
OutputAutomappings,StringBuilder (DiagnosticResults)	DefaultOutputFormatter.cs;26	19	66.7	63.5	49.73
GetCollectionMapping ()	ToManyBase.cs;723	38.1	35.9	75	49.67
ProcessHibernateMapping (HibernateMapping)	XmlHibernateMappingWriter.cs;28	42.9	28.2	77.3	49.47
Setup ()	PersistenceSpecificationTester.cs;84	4.8	47.4	94.6	48.93

Method	Location	CC	SLOC	# clone lines	Aggr. rating
OutputConventions,StringBuilder (DiagnosticResults)	DefaultOutputFormatter.cs;88	14.3	46.2	86.1	<b>48.87</b>
KeyProperty,Member,string (Action<KeyPropertyPart>)	CompositeIdentityPart.cs;70	19	33.3	92.3	<b>48.20</b>
BuildConfiguration()	FluentConfiguration.cs;243	23.8	24.4	89.5	<b>45.90</b>
ProcessKey(KeyMapping)	XmlKeyWriter.cs;24	33.3	21.8	82.4	<b>45.83</b>
ProcessJoin (JoinMapping)	XmlJoinWriter.cs;26	38.1	24.4	73.7	<b>45.40</b>
ProcessVersion (VersionMapping)	XmlVersionWriter.cs;24	28.6	19.2	86.7	<b>44.83</b>
GetDefaultName()	ToManyBase.cs;760	23.8	21.8	88.2	<b>44.60</b>
GetDynamicComponentProperty(Expression)	ReflectionHelper.cs;64	23.8	28.2	81.8	<b>44.60</b>
AssertGenericListMatches,IEnumerable (IEnumerable<TListElement>)	ReferenceBag.cs;20	28.6	34.6	70.4	<b>44.53</b>
GetJoinMapping()	JoinPart.cs;138	38.1	39.7	54.8	<b>44.20</b>
Convert<T> (Expression<Func<T,bool>>)	ExpressionToSql.cs;31	33.3	15.4	83.3	<b>44.00</b>
Add (Type)	PersistenceModel.cs;130	23.8	29.5	78.3	<b>43.87</b>
WriteComponent,string (IComponentMapping)	BaseXmlComponentWriter.cs;20	28.6	20.5	81.2	<b>43.43</b>
Main()	Program.cs;27	9.5	55.1	65.1	<b>43.23</b>
EditDistance,string(string)	StringLikeness.cs;15	47.6	46.2	33.3	<b>42.37</b>
KeyReference,Member,IEnumerable<string> (Action<KeyManyToOnePart>)	CompositeIdentityPart.cs;144	14.3	26.9	85.7	<b>42.30</b>
AcceptVisitor (IMappingModelVisitor)	MappedMembers.cs;188	47.6	26.9	52.4	<b>42.30</b>
ShouldBeThrownBy,Type (MethodThatThrows)	SpecificationExtensions.cs;248	14.3	23.1	88.9	<b>42.10</b>
ImportProviders (PersistenceModel)	PersistenceModel.cs;313	19	23.1	83.3	<b>41.80</b>
PairFuzzyMatches,IEnumerable<CollectionMapping>,CollectionMapping (IEnumerable<CollectionMapping>)	RelationshipPairingVisitor.cs;134	19	23.1	83.3	<b>41.80</b>

Method	Location	CC	SLOC	# clone lines	Aggr. rating
ProcessKeyManyToOne (KeyManyToOneMapping)	XmlKeyManyToOneWriter.cs;25	42.9	24.4	57.9	<b>41.73</b>
ShouldMap (Member)	HasManyToManyStep.cs;22	28.6	14.1	81.8	<b>41.50</b>
Check (XmlDocument)	XmlWriterTestHelper.cs;89	14.3	21.8	88.2	<b>41.43</b>
TryMapProperty, ClassMappingBase, Member (IList<Member>)	AutoMapper.cs;162	33.3	15.4	75	<b>41.23</b>
ProcessCollection (CollectionMapping)	ConventionVisitor.cs;85	9.5	24.4	89.5	<b>41.13</b>
Convert<T> (Expression<Func<T, object>>)	ExpressionToSql.cs;14	23.8	15.4	83.3	<b>40.83</b>
ParentModelMapping ()	ParentModelMapping.cs;11	4.8	37.2	79.3	<b>40.43</b>
ProcessManyToMany (ManyToManyMapping)	XmlManyToManyWriter.cs;26	47.6	29.5	43.5	<b>40.20</b>
ContentEquals (AttributeLayeredValues)	AttributeLayeredValues.cs;54	23.8	17.9	78.6	<b>40.10</b>
ProcessProperty (PropertyMapping)	XmlPropertyWriter.cs;24	47.6	30.8	41.7	<b>40.03</b>
GetHashCode ()	ReferenceComponentMapping.cs;216	23.8	14.1	81.8	<b>39.90</b>
ProcessCollection (CollectionMapping)	ManyToManyTableNameVisitor.cs;8	23.8	20.5	75	<b>39.77</b>

# 5 Appendix

## 5.1 Project Data

### 5.1.1 General Settings

- Currency: USD
- Man-hour price: 50\$
- Hours in a person-week: 40
- Weeks in a person-month (avg.): 4.3
- Hours per person-month (avg.): 172

### 5.1.2 Historical

The following data from previous analysis runs of the project are used (last 30):

Date	Analysability	Changeability	Testability	Overall maint. rating
2013/04/23 08:47	0,1	-1,6	1	-0,17
2013/04/25 08:47	0,1	-1,5	1,05	-0,11
2013/04/27 08:47	0,2	-1,4	1,1	-0,05
2013/04/29 08:47	0,2	-1,3	1,15	0,01
2013/05/01 08:47	0,2	-1,2	1,2	0,07
2013/05/03 08:47	0,3	-1,1	1,25	0,13
2013/05/05 08:47	0,3	-1	1,3	0,19
2013/05/07 08:47	0,3	-0,9	1,35	0,25
2013/05/09 08:47	0,3	-0,8	1,4	0,31
2013/05/11 08:47	0,4	-0,7	1,35	0,34
2013/05/13 08:47	0,4	-0,6	1,3	0,37
2013/05/15 08:47	0,4	0	1,25	0,56
2013/05/17 08:47	0,5	0,1	1,2	0,59
2013/05/19 08:47	0,5	0,2	1,25	0,65
2013/05/21 08:47	0,5	0,3	1,3	0,71
2013/05/23 08:47	0,6	0,4	1,35	0,77
2013/05/25 08:47	0,6	0,5	1,4	0,83
2013/05/27 08:47	0,6	0,6	1,45	0,89
2013/05/29 08:47	0,6	0,7	1,5	0,95
2013/05/31 08:47	0,7	0,8	1,55	1,01
2013/06/02 08:47	0,7	0,9	1,6	1,07

Date	Analysability	Changeability	Testability	Overall maint. rating
2013/06/04 08:47	0,7	1	1,5	1,08
2013/06/06 08:47	0,8	1,1	1,4	1,09
2013/06/08 08:47	0,8	1,2	1,3	1,10
2013/06/10 08:47	0,8	1,3	1,2	1,11
2013/06/12 08:47	0,9	1,4	1,3	1,18
2013/06/14 08:47	0,9	1,3	1,4	1,19
2013/06/16 08:47	0,9	1,2	1,4	1,17
2013/06/18 08:47	0,9	1,1	1,5	1,18
2013/06/20 08:47	0,9	1	1,5	1,13

### 5.1.3 Custom

The following custom data series are defined:

- **Sales (USD)**  
Description: Overall sales figures of the software development department in USD.
- **# Bugs**  
Description: The number of new bugs that were reported during a 2-week period.

The data series can be viewed [here](#) (<link to project data on .CQ web site>).

## 5.2 Methodology

### 5.2.1 Maintainability assessment and source code metrics

The assessment of source code properties uses a procedure that is basically a simplified version of the [SIG Maintainability Model](#). It maps source code metrics to software maintenance categories as defined by the [ISO/IEC 9126 standard](#).

A detailed description of this approach and the involved source code metrics can be found [here](#) (<link to explanatory page on .CQ web site>).

### 5.2.2 Statistics

The statistical part of this report maps user-defined data against the project's measured maintainability scores, resulting in discrete data pairs. The statistical correlation between the two variables is then computed using [Spearman's rank correlation coefficient](#).

A detailed description of the statistical approach can be found [here](#) (<link to explanatory page on .CQ web site>).