SAPHIRE 8 Quality Assurance Software Metrics Report

Kurt G. Vedros

August 2011

The INL is a U.S. Department of Energy National Laboratory operated by Battelle Energy Alliance

SAPHIRE 8 Quality Assurance Software Metrics Report

Kurt G. Vedros

August 2011

**Idaho National Laboratory
Idaho Falls, Idaho 83415**

<http://www.inl.gov>

**Prepared for the
U.S. Nuclear Regulatory Commission
Washington, DC 20555
Project Number V6059**

Table of Contents

1	Executive Summary	1
2	Background Information	2
3	Software Metrics Tools Used.....	2
3.1	CodeHealer	2
3.1.1	CodeHealer Results	3
3.2	Coverage Validator	34
3.2.1	Coverage Validator Results	34
3.3	Memory Validator	35
3.3.1	Memory Validator Results	35
3.4	Performance Validator	36
3.4.1	Performance Validator Results	36
3.5	Thread Validator	44
3.5.1	Thread Validator Results	44
3.6	Bug Reporting and Trends	49
4	Conclusions	49

Table of Figures

Figure 3-1	Source Code Analysis for CodeHealer SAPHIRE 8 v8.06.01	31
Figure 3-2	Audits Category for CodeHealer Project SAPHIRE 8 Analysis.....	32
Figure 3-3	Checks Category Settings for CodeHealer Project SAPHIRE 8 Analysis.....	33
Figure 3-4	Memory Validator Memory Leak and Handle Leak Detection v8.06.01	36
Figure 3-5	Memory Validator Memory Leak and Handle Leak Detection v8.07.17	36
Figure 3-6	SAPHIRE 8 v8.06.01 Performance Validator SDP Statistics Report - Left..	38
Figure 3-7	SAPHIRE 8 v8.06.01 Performance Validator SDP Statistics Report - Right	39
Figure 3-8	SAPHIRE 9 v8.06.01 Performance Validator ECA Statistics Report - Left .	40
Figure 3-9	SAPHIRE 8 v8.06.01 Performance Validator ECA Statistics Report - Right	41
Figure 3-10	SAPHIRE 8 v8.06.01 Performance Validator General Analysis Statistics Report - Left.....	42

Figure 3-11 SAPHIRE 8 v8.06.01 Performance Validator General Analysis Statistics Report - Right	43
Figure 3-12 Thread Validator Lock Colors Definitions	45
Figure 3-13 SAPHIRE 8 v8.06.01 Thread Validator SDP Critical Sections and Waits Report.....	46
Figure 3-14 SAPHIRE 8 v8.06.01 Thread Validator ECA Critical Sections and Waits Report.....	47
Figure 3-15 SAPHIRE 8 v8.06.01 Thread Validator General Analysis Critical Sections and Waits Report.....	48

1 Executive Summary

The purpose of this report of the software metrics review is to review the results of the 2010 IV&V and to set an outline for results of updated metrics runs to be performed going forward.

The purpose of the software metrics review is to show maintenance of accepted quality standards presented in SAPHIRE 8's Independent Verification and Validation (IV&V) of April, 2010. Recommendations from the final IV&V were to continue periodic measurable metrics such as McCabe's complexity measure to ensure quality is maintained. The four software tools used to measure quality in the IV&V were CodeHealer, Coverage Validator, Memory Validator, Performance Validator, and Thread Validator. These will be re-run with the latest revision of SAPHIRE 8 for results comparison.

2 Background Information

NUREG/BR-0167, Software Quality Assurance Program and Guidelines notes that “no metrics to support an IEEE-1012 classification higher than a ‘1’ currently exists”; however, Section 5.2.4 requires that “metrics be part of the Tracking and Oversight function”. The metrics chosen for quality in the IV&V were from the software tools CodeHealer, Coverage Validator, Memory Validator, Performance Validator, and Thread Validator.

The IV&V team suggested a couple of metrics that could be implemented to further track and approve quality. A metric considered at the time of the final report was an “error tracking” metric which was the errors discovered by IV&V while evaluating the Significance Determination Process (SDP). This potentially could be compared to other development module error tracking. This would require the development team to track code errors for comparison. Bug resolution tracking was suggested as well. It was suggested that a metric of a Pareto diagram of the bug resolutions could prove useful.

3 Software Metrics Tools Used

3.1 CodeHealer

Table 7-1 provides an overview of the basic constructs used in the SAPHIRE version 8 source code using the source code analysis and verification tool CodeHealer for Delphi © Version 2.5.0. Any and all extra characters after the terminating “end.” of a program, unit or project file are ignored, and any extra lines are always treated as blank lines, regardless of what they contain. It is possible for the total number of lines to be greater than the sum of the number of blank lines, the number of code lines and the number of comment lines if one or more lines contain a number of spaces or tab characters and nothing else, since these lines do not fit in any of the counted categories.

The majority of the metrics values are self explanatory from their name, such as the number of characters, lines, units or other basic item, so are not defined further here. Certain metrics values, however, justify further explanation, and these are listed below.

Note that because the metric values are displayed on a module basis, the Branches, Loops and Cyclomatic complexity metrics values are calculated and shown as an average of the values for each function, procedure and (class) method in the module, rather than as a total for the module.

Branches – This metric value is the average number of branches per function or procedure that occur within the source code of the selected items. A branch in the source code is an “if”, “goto”, “try .. except” statement or a case item or “else” value of a “case” statement, and represents a point where the flow of control may take one of two alternative routes. The number of branches within a function, procedure or module is (historically) considered as a very basic indicator of its complexity.

Loops – This metric value is the total number of loops that occur within the source code of the selected items. A loop in the source code is a “for”, “repeat” or “while” statement, and represents a point where the flow of control may take one of two alternative routes on more than one occasion. The number of loops within a function, procedure or module is (historically) considered as a very basic indicator of its complexity.

Cyclomatic Complexity – This metric value was introduced by Thomas McCabe in 1976, and it measures the number of possible paths through a source code item. It is widely considered a broad measure of soundness and confidence for a program, and also gives an indication of the minimum number of test cases that are necessary to properly test each item of the program. The cyclomatic complexity of a module is calculated as the average of the cyclomatic complexity values of each function, procedure and (class) method of the module. Table 7-2 provides the individual SAPHIRE Version 8 source code files Cyclomatic Complexity. The cyclomatic complexity of a function, procedure or (class) method is calculated as:

1 + Branches + Loops + Number of logical “and” and “or” operations within conditional expressions where Branches and Loops are calculated as defined above.

The Carnegie Mellon Software Engineering Institute definition of Cyclomatic Complexity can be viewed at “CMU – Cyclomatic Complexity”, and part of that definition is the following suggested set of threshold values that may be used to assess the risk associated with modifying a module:

Complexity	Risk evaluation for the module or program
1 – 10	Relatively simple, without much risk
11 – 20	More complex, moderate risk
21 – 50	Complex, high risk
Greater than 50	Untestable (very high risk)

3.1.1 CodeHealer Results

Table 3-1 Source Code Metrics for CodeHealer Project SAPHIRE 8

Metric Value	Total v8.06.01	Total v8.07.17
Source Files	1,291	
Programs	6	
Libraries	12	
Packages	1	
Units	1,272	
Forms	405	
Main Used Units	1,428	
Used Units (not unique)	20,981	
Characters	53,035,946	
Lines	1,846,865	
Blank Lines	371,863	
Branches (average)	2	

Metric Value	Total v8.06.01	Total v8.07.17
Loops (average)	1	
Cyclomatic Complexity (average)	4	
Commented Code Lines	41,869	
Pure Code Lines	1,182,202	
Code Lines	1,224,071	
Significant Comment Lines	242,243	
Blank Comment Lines	7,711	
Comment Lines	249,954	
Total Comments (%)	19%	
Significant Comments (%)	19%	
Classes	1,775	
Interfaces	27	
Objects	0	
Properties	5,346	
Constructors	1,295	
Destructors	736	
Functions	12,439	
Procedures	32,047	
Initializations	84	
Finalizations	35	
Keywords	796,973	
Directives	65,281	
Identifiers	2,168,392	
Hex Integers	8,665	
Integers	174,790	
Labels	2	
Reals	11,735	
String Constants	75,985	

Table 3-2 Individual SAPHIRE 8 Source Code File Cyclomatic Complexity

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
AboutUnit	C:\Saphire 8\Debug\source\schemaObjects\	1	
AdjListPanel	C:\Saphire 8\Debug\source\DelphiSource\	6	
AnalysisPointEObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	
AnalysisPointFTCSPathObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	7	
AnalysisPointFTObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	6	
AnalysisPointObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
AnalyzeGeneral.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
AnalyzeSDP.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
API_AnalysisType.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_Assess.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
API_Assess.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_BlockDiagram.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_Cat.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Category.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_ChgSet.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_CompareProject.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Constants.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_DefSolve.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_EndState.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_ESCat.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_EvCat.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
API_EvCmpLib.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_Event.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
API_Event.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_EventSet.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_EventTree.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
API_EventTree.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_Extract.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_Gate.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Gather.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Generate.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Histogram.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Importance.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_Load.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Logic.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_MergeProjects.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Partition.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_Phase.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Project.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_Quantify.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_RaspCCF.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Recover.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_ReportCust.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Reports7.pas	C:\Saphire	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
	8\Debug\source\DelphiSource\RiskApi\		
API_Risk.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_RiskErr.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_RiskMacro.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_RulesCode.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_Sequence.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
API_Sequence.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Simulation.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Slice.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_System.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	2	
API_TreeRead.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Uncertainty.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
API_Update.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	0	
API_WorkSpace.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
API_WorkSpace.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	1	
APIX_XOverMain.pas	C:\Saphire 8\Debug\source\DelphiSource\RiskApi\	3	
ApplicableTypes.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
ApplicableTypes.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
ASCIIX.pas	C:\Saphire 8\Debug\source\	0	
AscRptLib.pas	C:\Saphire 8\Debug\source\	6	
AutoFT.pas	C:\Saphire 8\Debug\source\DelphiSource\BddItems\	14	
AuxSpec.pas	C:\Saphire 8\Debug\source\	0	
BaseDef.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	1	
BaseDefs.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
BasicFieldClass.pas	C:\Saphire 8\Debug\source\	2	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
BasicRelationClass.pas	C:\Saphire 8\Debug\source\	2	
BasicSchemaClass.pas	C:\Saphire 8\Debug\source\	2	
BENodeEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\	13	
BENodeEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	5	
BEObject.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
BEObject.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	4	
BEProbability.pas	C:\Saphire 8\Debug\source\DelphiSource\	14	
BEQuick.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
BEQuick.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
BESelectList.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
BinLib.pas	C:\Saphire 8\Debug\source\	3	
BitLib.pas	C:\Saphire 8\Debug\source\	2	
BitMapFont.pas	C:\Saphire 8\Debug\source\	5	
BitSetObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
BlkEdit.pas	C:\Saphire 8\Debug\source\	3	
BlockDataLib.pas	C:\Saphire 8\Debug\source\	4	
BlockIO.pas	C:\Saphire 8\Debug\source\	8	
BMPLib.pas	C:\Saphire 8\Debug\source\	9	
BookmarksObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
Btree.pas	C:\Saphire 8\Debug\source\	6	
BtreeBuf.pas	C:\Saphire 8\Debug\source\	7	
BtrList.pas	C:\Saphire 8\Debug\source\	4	
BtrListClass.pas	C:\Saphire 8\Debug\source\	2	
BtrStack.pas	C:\Saphire 8\Debug\source\	4	
BufIO.pas	C:\Saphire 8\Debug\source\	6	
Cache.pas	C:\Saphire 8\Debug\source\	6	
CatAPI.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
CategoryObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
CategoryObj.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
CatLib.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
CCFData.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
CCFEvLib.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
CCFRAAlpha.pas	C:\Saphire	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
	8\Debug\source\DelphiSource\RaspCCF\		
CCFRBase.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	4	
CCFRBeta.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	3	
CCFRCalc.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	1	
CCFRCommon.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	2	
CCFRData.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	4	
CCFRDebug.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	3	
CCFRDLL.dpr	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	2	
CCFRInterface.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	1	
CCFRLib.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	2	
CCFRMGL.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	4	
CCFRObj.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	4	
CCFROutput.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	3	
CCFRReport.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	2	
CCFRStag.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	4	
CCFRUtil.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	5	
CCFRVBE.pas	C:\Saphire 8\Debug\source\DelphiSource\RaspCCF\	2	
CFStag.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	2	
CCLib.pas	C:\Saphire 8\Debug\source\	2	
CCProcs.pas	C:\Saphire 8\Debug\source\	15	
CFGLib.pas	C:\Saphire 8\Debug\source\	6	
CGMWin.pas	C:\Saphire 8\Debug\source\	10	
ChangeSet.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
ChangeSet.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
CheckLib.pas	C:\Saphire 8\Debug\source\	1	
chgset.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
ChgSetNodeEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
ChgSetNodeEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	3	
ClassCngTreeNode.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	6	
ClipBoard.pas	C:\Saphire 8\Debug\source\	3	
CmndLine.pas	C:\Saphire 8\Debug\source\	7	
CodeGenCommon.pas	C:\Saphire 8\Debug\source\	6	
CodeGenerator.pas	C:\Saphire 8\Debug\source\	3	
CodeGenerator.pas	C:\Saphire 8\Debug\source\schemaObjects\	3	
CodeLib.pas	C:\Saphire 8\Debug\source\	13	
CodeMerg.pas	C:\Saphire 8\Debug\source\	11	
Coder.pas	C:\Saphire 8\Debug\source\	3	
CompareBE.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareCS.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareDflt.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareES.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareET.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareFT.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareGT.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
CompareHtml.pas	C:\Saphire 8\Debug\source\DelphiSource\	9	
Compress.pas	C:\Saphire 8\Debug\source\	6	
Conversions.pas	C:\Saphire 8\Debug\source\	6	
Convert.pas	C:\Saphire 8\Debug\source\	4	
ConvertReal.pas	C:\Saphire 8\Debug\source\	11	
Crypto.pas	C:\Saphire 8\Debug\source\	13	
CtrlBtn.pas	C:\Saphire 8\Debug\source\	2	
CtrlCBox.pas	C:\Saphire 8\Debug\source\	2	
CtrlComb.pas	C:\Saphire 8\Debug\source\	2	
CtrlEdit.pas	C:\Saphire 8\Debug\source\	2	
CtrlGrid.pas	C:\Saphire 8\Debug\source\	3	
CtrlList.pas	C:\Saphire 8\Debug\source\	3	
CtrlLV.pas	C:\Saphire 8\Debug\source\	2	
CtrlRBtn.pas	C:\Saphire 8\Debug\source\	2	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
CtrlRich.pas	C:\Saphire 8\Debug\source\	3	
CtrlSBar.pas	C:\Saphire 8\Debug\source\	2	
CtrlSppt.pas	C:\Saphire 8\Debug\source\	3	
CtrlStat.pas	C:\Saphire 8\Debug\source\	1	
CtrlTree.pas	C:\Saphire 8\Debug\source\	3	
CtrlWin.pas	C:\Saphire 8\Debug\source\	2	
CustCntl.pas	C:\Saphire 8\Debug\source\	0	
CustRptLib.pas	C:\Saphire 8\Debug\source\DelphiSource\	37	
DataPack.pas	C:\Saphire 8\Debug\source\hfdll\	0	
DBLoad.pas	C:\Saphire 8\Debug\source\	9	
DBMerge.pas	C:\Saphire 8\Debug\source\	6	
DCompile.pas	C:\Saphire 8\Debug\source\	10	
DDAccess.pas	C:\Saphire 8\Debug\source\	9	
DDUniversal.pas	C:\Saphire 8\Debug\source\	4	
DesignOperation.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	1	
Dialog.pas	C:\Saphire 8\Debug\source\	2	
Disklib.pas	C:\Saphire 8\Debug\source\	4	
Display.pas	C:\Saphire 8\Debug\source\	5	
DisplayW.pas	C:\Saphire 8\Debug\source\	7	
dlgConfirmReplace.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	2	
dlgReplaceText.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	3	
DlgSageSTMain.pas	C:\Saphire 8\Debug\source\	0	
dlgSearchText.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	2	
DMCat.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
DMRegExpMatching.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
DosLib.pas	C:\Saphire 8\Debug\source\	4	
DTstGen.pas	C:\Saphire 8\Debug\source\DelphiSource\BddItems\HashTableLib\	3	
DWLib.pas	C:\Saphire 8\Debug\source\	4	
DWSpec.pas	C:\Saphire 8\Debug\source\	0	
EditAnalysisPoint.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
EditETAnalysisPoint.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
EditEvent.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
EditEventEndstate.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
EditEventEndstateCol.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
EditEventTree.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
EditFaultTreeObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	6	
EditLib.pas	C:\Saphire 8\Debug\source\	6	
EditRBlockObject.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
EnvironmentX.pas	C:\Saphire 8\Debug\source\	4	
ErrorLog.pas	C:\Saphire 8\Debug\source\	7	
ESCatEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
ETGroupObj.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
ETObject.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
EventEndObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
EventIns.pas	C:\Saphire 8\Debug\source\	6	
EventObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
EventScheduler.pas	C:\Saphire 8\Debug\source\DelphiSource\	9	
EventSetObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
EventTreeObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	5	
EventView1.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
EvProbList.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
EvTCatObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
ExcelOut.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
Exec.pas	C:\Saphire 8\Debug\source\	1	
ExpOpt.pas	C:\Saphire 8\Debug\source\	8	
ExStorageX.pas	C:\Saphire 8\Debug\source\	4	
EZDSLCTS.PAS	C:\Saphire 8\Debug\source\DelphiSource\BddItems\HashTableLib\	0	
FastMM4.pas	C:\Saphire 8\Debug\source\fastmm\	6	
FastMM4Messages.pas	C:\Saphire 8\Debug\source\fastmm\	0	
FaultTreeObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	5	
FileEdit.pas	C:\Saphire 8\Debug\source\	3	
FileFunc.pas	C:\Saphire 8\Debug\source\	6	
FileQuery.pas	C:\Saphire 8\Debug\source\	2	
Files.pas	C:\Saphire 8\Debug\source\	4	
FilesOp.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FileUtil.pas	C:\Saphire 8\Debug\source\	7	
FilterFunctions.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FixLib.pas	C:\Saphire 8\Debug\source\	9	
FlagLib.pas	C:\Saphire 8\Debug\source\	4	
FldFlags.pas	C:\Saphire 8\Debug\source\	8	
Fonts.pas	C:\Saphire 8\Debug\source\	4	
Form_BDD_FT_Solve.pas	C:\Saphire 8\Debug\source\DelphiSource\BddItems\	3	
Form_ErrorLog.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
Form_Histograms.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
Form_SeqProperties.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormAccidentMatrix.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormAnalysisType.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormAnalysisTypeEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormASP.pas	C:\Saphire 8\Debug\source\DelphiSource\	7	
FormASP1.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormASP2.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormASP3.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormBE.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormBEDData.pas	C:\Saphire 8\Debug\source\hfdll\	5	
FormBEDDataEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	5	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
FormBookmarkAdd.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormCategories.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormCategoryEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormChangeBE.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormChangeSet.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	3	
FormChangeSetEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	2	
FormChk.pas	C:\Saphire 8\Debug\source\	1	
FormCompareDBs.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormCustomPrint.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	5	
FormCustReportList.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormCustRptEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormCutSetViewer.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormCutsetViewerES.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormCutSetViewerET.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormCutSetViewerFT.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormDesignEdtBase.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormDocManager.pas	C:\Saphire 8\Debug\source\DelphiSource\	6	
FormEditBookmarks.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormEditETGroups.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormEditEventGroups.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormEndStateEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormESCategory.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormET.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormETEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	
FormETGraphicalDisp.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	6	
FormETGraphicOnly.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormExtractProject.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormFlagSetEdit.pas	C:\Saphire	2	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
	8\Debug\source\DelphiSource\EventEditing\		
FormFlagSets.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormFT.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormFTCSGraphicalDisp.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
FormFTCSPathViewer.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	1	
FormFTEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
FormFTGraphicalDisp.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	5	
FormFTGraphicOnly.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormGenAn.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormGenAn1.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormGenAn2.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormGenAn3.pas	C:\Saphire 8\Debug\source\DelphiSource\	9	
FormGenAn4.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormGraphicalDispBase.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	
FormHistogramEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormHistograms.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormImpExp.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormImport.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormImportanceM.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormLib.pas	C:\Saphire 8\Debug\source\	7	
FormLink.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormLinkProgress.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormLinkResults.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormLoadExtProb.pas	C:\Saphire 8\Debug\source\DelphiSource\ImportExport\	2	
FormLoadExtract.pas	C:\Saphire 8\Debug\source\DelphiSource\	15	
FormLoadExtractProbs.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormMacroManager.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
FormMacroRunner.pas	C:\Saphire 8\Debug\source\DelphiSource\	19	
FormMain.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormMinMax.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormModelDataEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	3	
FormModelDataTab.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	3	
FormModelType.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormModelTypeEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormNameDesc.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
FormNewItemData.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	1	
FormNewProject.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormPhase.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormPhaseEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormPID.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormProjCheck.pas	C:\Saphire 8\Debug\source\DelphiSource\	7	
FormProjectUpdate.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormPublish.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormPublish2.pas	C:\Saphire 8\Debug\source\DelphiSource\	7	
FormQuickEditEventES.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormQuickEditEventESCol.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormQuickEditEventTree.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormQuickEditFaultTree.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormQuickEditTopEvent.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
FormQuickSearch.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	1	
FormRaspCmpd.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormRebuildUpgrade.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
FormResultsViewer.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormResultsViewer.pas	C:\Saphire 8\Debug\source\DelphiSource\ResultsViewer\	3	
FormResultsViewerES.pas	C:\Saphire 8\Debug\source\DelphiSource\ResultsViewer\	3	
FormResultsViewerET.pas	C:\Saphire 8\Debug\source\DelphiSource\ResultsViewer\	4	
FormResultsViewerFT.pas	C:\Saphire 8\Debug\source\DelphiSource\ResultsViewer\	2	
FormRuleEdETLink.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	2	
FormRuleEdETPart.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdETRec.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdFTRec.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdProjETRec.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdProjFTRec.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdProjPart.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdSlice.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdSQPart.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormRuleEdSQRec.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
FormSampleOps.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormSaveWorkspace.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormSDP.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSDP1.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormSDP2.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSDP3.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormSDP4.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormSDPAdvancedRpt.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSDPLerfFactors.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
FormSearch.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSearchAdv.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormSetChangesBase.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	4	
FormSimulation.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormSimulationEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSimulationEvent.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSimulationName.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormSimulationState.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormSimulationTrigger.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormSliceBy.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormSolveResults.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormSolveSettings.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormStartup.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormStepManager.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FormTemplate.pas	C:\Saphire 8\Debug\source\DelphiSource\	6	
FormToolBar.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
FormUncertainty.pas	C:\Saphire 8\Debug\source\DelphiSource\	6	
FormUserSetting.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
FormViewHtml.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormViewPdf.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormWarnSPAR.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormWManager.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
FormWorkspace.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FormXReference.pas	C:\Saphire 8\Debug\source\DelphiSource\	9	
FrameDuration.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
FrameETGraphicalDisp.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	6	
FrameFTCSGraphicalDisp.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	3	
FrameFTGraphicalDisp.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	5	
FrameGraphicalDispBase.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	
FrameHdrModelInfo.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
FrameHdrProjectInfo.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FrameNotes.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
frmRulesEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	3	
FTObject.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
FTObject.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
FX.pas	C:\Saphire 8\Debug\source\	8	
GateObj.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	3	
GdiPrint.pas	C:\Saphire 8\Debug\source\	10	
GdiUtil.pas	C:\Saphire 8\Debug\source\	1	
GdiView.pas	C:\Saphire 8\Debug\source\	9	
GemH.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
GenAn_Editors.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
GenAnSupport.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
GIFImage.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
GrafDef.pas	C:\Saphire 8\Debug\source\	0	
Graph2D.pas	C:\Saphire 8\Debug\source\	6	
GraphicalModelObj.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	
GroupData.pas	C:\Saphire 8\Debug\source\	6	
HashLib.pas	C:\Saphire 8\Debug\source\	5	
HashTable.pas	C:\Saphire 8\Debug\source\DelphiSource\BddItems\HashTableLib\	4	
HelpLib.pas	C:\Saphire 8\Debug\source\	1	
HelpTopics.pas	C:\Saphire 8\Debug\source\DelphiSource\	51	
HRADef.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
HRADLL.dpr	C:\Saphire 8\Debug\source\hfdll\	5	
HTML.pas	C:\Saphire 8\Debug\source\	7	
HtmlHelp.pas	C:\Saphire 8\Debug\source\	2	
HyperTxt.pas	C:\Saphire 8\Debug\source\	10	
ImportCSPathDataObj.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
ImportETDataObject.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
	ng\		
ImportExpBE.pas	C:\Saphire 8\Debug\source\DelphiSource\ImportExport\	6	
ImportFTDataObj.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	4	
InBios.pas	C:\Saphire 8\Debug\source\	3	
InfoLib.pas	C:\Saphire 8\Debug\source\	6	
IniDefs.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
Inputs.pas	C:\Saphire 8\Debug\source\	8	
IOUniversal.pas	C:\Saphire 8\Debug\source\	3	
LangMap.pas	C:\Saphire 8\Debug\source\	4	
LibSequence.pas	C:\Saphire 8\Debug\source\	6	
LinkList.pas	C:\Saphire 8\Debug\source\	3	
LinkObject.pas	C:\Saphire 8\Debug\source\	6	
LinksEd.pas	C:\Saphire 8\Debug\source\	4	
ListObj.pas	C:\Saphire 8\Debug\source\	7	
Literal.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	1	
LitTypes.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	0	
Logger.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
LogLib.pas	C:\Saphire 8\Debug\source\	9	
LowLongX.pas	C:\Saphire 8\Debug\source\	4	
MainForm.pas	C:\Saphire 8\Debug\source\schemaObjects\	3	
Manager.pas	C:\Saphire 8\Debug\source\	4	
MathL.pas	C:\Saphire 8\Debug\source\	4	
MathLib.pas	C:\Saphire 8\Debug\source\	2	
MaxFiles.pas	C:\Saphire 8\Debug\source\	2	
MBlkEdit.pas	C:\Saphire 8\Debug\source\	3	
MEditLib.pas	C:\Saphire 8\Debug\source\	7	
MemCheck.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
MenuLib.pas	C:\Saphire 8\Debug\source\	7	
MergeAPI.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
MMTools.pas	C:\Saphire 8\Debug\source\	2	
ModelData.pas	C:\Saphire 8\Debug\source\DelphiSource\	7	
ModelData.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
ModelDataCSTreeNode.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	3	
ModelDataDefs.pas	C:\Saphire 8\Debug\source\DelphiSource_ProjObjects\	23	
ModelDataTreeNode.pas	C:\Saphire 8\Debug\source\DelphiSource\EventEditing\	6	
ModelLib.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
ModelTypeObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
ModSys.pas	C:\Saphire 8\Debug\source\	1	
MoveLib.pas	C:\Saphire 8\Debug\source\	2	
MSageLib.pas	C:\Saphire 8\Debug\source\	7	
MsgChk.pas	C:\Saphire 8\Debug\source\	1	
MsgWrap.pas	C:\Saphire 8\Debug\source\	2	
MultSage.pas	C:\Saphire 8\Debug\source\	5	
MultUser.pas	C:\Saphire 8\Debug\source\	3	
MusicLib.pas	C:\Saphire 8\Debug\source\	10	
MynerDFM.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	2	
NewFormFT.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
NewProject.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
NewSets.pas	C:\Saphire 8\Debug\source\	3	
NodePropertyForm.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
NumberIO.pas	C:\Saphire 8\Debug\source\	2	
ObjCalendar.pas	C:\Saphire 8\Debug\source\	7	
ObjCommon.pas	C:\Saphire 8\Debug\source\	1	
ObjDef.pas	C:\Saphire 8\Debug\source\	1	
ObjDefault.pas	C:\Saphire 8\Debug\source\	1	
ObjDialog.pas	C:\Saphire 8\Debug\source\	4	
ObjEMail.pas	C:\Saphire 8\Debug\source\	7	
ObjExec.pas	C:\Saphire 8\Debug\source\	4	
ObjExExe.pas	C:\Saphire 8\Debug\source\	3	
ObjExit.pas	C:\Saphire 8\Debug\source\	2	
ObjFtp.pas	C:\Saphire 8\Debug\source\	5	
ObjJustOne.pas	C:\Saphire 8\Debug\source\	3	
ObjLib.pas	C:\Saphire 8\Debug\source\	5	
ObjMenu.pas	C:\Saphire 8\Debug\source\	8	
ObjMessage.pas	C:\Saphire 8\Debug\source\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
ObjPool.pas	C:\Saphire 8\Debug\source\	4	
ObjPropSheet.pas	C:\Saphire 8\Debug\source\	5	
ObjSage.pas	C:\Saphire 8\Debug\source\	2	
ObjSequence.pas	C:\Saphire 8\Debug\source\	2	
ObjSplash.pas	C:\Saphire 8\Debug\source\	4	
ObjWindow.pas	C:\Saphire 8\Debug\source\	2	
Parser.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	19	
ParseRtf.pas	C:\Saphire 8\Debug\source\DelphiSource\	9	
PCXImage.pas	C:\Saphire 8\Debug\source\	1	
PidDir2Xml.pas	C:\Saphire 8\Debug\source\DelphiSource\	6	
PlugCCFStag.dpr	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	2	
PlugCCFUtil.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	20	
PlugDef.pas	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	0	
PlugDFM.dpr	C:\Saphire 8\Debug\source\DelphiSource\PlugIns\	2	
PntrDev.pas	C:\Saphire 8\Debug\source\	1	
Pool.pas	C:\Saphire 8\Debug\source\	6	
Profile.pas	C:\Saphire 8\Debug\source\	4	
ProgCmnd.pas	C:\Saphire 8\Debug\source\	4	
ProgramX.pas	C:\Saphire 8\Debug\source\	2	
ProjChanges.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
Project_Object.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
Publish.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
Qualify.pas	C:\Saphire 8\Debug\source\	9	
QueryAux.pas	C:\Saphire 8\Debug\source\	9	
QueryLib.pas	C:\Saphire 8\Debug\source\	9	
QuickBE.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
QuickEditObj.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	6	
RANCACHE.pas	C:\Saphire 8\Debug\source\	6	
Random.pas	C:\Saphire 8\Debug\source\	2	
RaspCCFObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
RConversions.pas	C:\Saphire 8\Debug\source\	7	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
ReliabilityBlockObject.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
RelLock.pas	C:\Saphire 8\Debug\source\	5	
Reports.pas	C:\Saphire 8\Debug\source\	5	
ResDir.pas	C:\Saphire 8\Debug\source\	4	
ResLib.pas	C:\Saphire 8\Debug\source\	12	
Resource.pas	C:\Saphire 8\Debug\source\	5	
RptCutSets.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
RptGraphics.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
RptGroups.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
RptImportance.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
RptObjs.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
RptTemplate.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
RTF.pas	C:\Saphire 8\Debug\source\	11	
RulesItem.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	4	
RulesSchema.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	1	
RulesUtil.pas	C:\Saphire 8\Debug\source\DelphiSource\	14	
RunProgX.pas	C:\Saphire 8\Debug\source\	4	
Sage.pas	C:\Saphire 8\Debug\source\	4	
SageBtn.pas	C:\Saphire 8\Debug\source\	10	
SageCBox.pas	C:\Saphire 8\Debug\source\	11	
SageCC.pas	C:\Saphire 8\Debug\source\	0	
SageComb.pas	C:\Saphire 8\Debug\source\	14	
SageDialogs.pas	C:\Saphire 8\Debug\source\	9	
SageDyn.pas	C:\Saphire 8\Debug\source\	7	
SageEdit.pas	C:\Saphire 8\Debug\source\	16	
SageErrs.pas	C:\Saphire 8\Debug\source\	2	
SageFinal.pas	C:\Saphire 8\Debug\source\	1	
SageGrid.pas	C:\Saphire 8\Debug\source\	9	
SageInit.pas	C:\Saphire 8\Debug\source\	1	
SageKey.pas	C:\Saphire 8\Debug\source\	7	
SageLib.pas	C:\Saphire 8\Debug\source\	7	
SageList.pas	C:\Saphire 8\Debug\source\	9	
SageLV.pas	C:\Saphire 8\Debug\source\	6	
SageMask.pas	C:\Saphire 8\Debug\source\	11	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
SageMenu.pas	C:\Saphire 8\Debug\source\	7	
SageOpt.pas	C:\Saphire 8\Debug\source\	11	
SageRBtn.pas	C:\Saphire 8\Debug\source\	10	
SageRich.pas	C:\Saphire 8\Debug\source\	11	
SageRisk2.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
SageRiskUtil.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
SageSBar.pas	C:\Saphire 8\Debug\source\	7	
SageSpec.pas	C:\Saphire 8\Debug\source\	2	
SageSplash.pas	C:\Saphire 8\Debug\source\	2	
SageST.dpr	C:\Saphire 8\Debug\source\	1	
SageStat.pas	C:\Saphire 8\Debug\source\	8	
SageSTDataSet.pas	C:\Saphire 8\Debug\source\	3	
SageSTObject.pas	C:\Saphire 8\Debug\source\	2	
SageSTPackage.dpk	C:\Saphire 8\Debug\source\	0	
SageSTSchemaObjects.dpr	C:\Saphire 8\Debug\source\schemaObjects\	1	
SageTerm.pas	C:\Saphire 8\Debug\source\	4	
SageTree.pas	C:\Saphire 8\Debug\source\	14	
SaphCache.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
SaphDataM.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
SAPHIRE.dpr	C:\Saphire 8\Debug\source\DelphiSource\	5	
SAPHIRE_Project.dpr	C:\Saphire 8\Debug\source\DelphiSource\	9	
SAPHIRE8.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
SaphireAnalysis.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
saphmacro.pas	C:\Saphire 8\Debug\source\DelphiSource\	24	
SaphSet.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
ScanLib.pas	C:\Saphire 8\Debug\source\	1	
Scroll.pas	C:\Saphire 8\Debug\source\	9	
SDP_Editors.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
SDP_Insights.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
SDPReports.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
SearchObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
SecurLib.pas	C:\Saphire 8\Debug\source\	3	
Select.pas	C:\Saphire 8\Debug\source\	2	
SelectModel.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
Semaphore.pas	C:\Saphire 8\Debug\source\	4	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
SetLib.pas	C:\Saphire 8\Debug\source\	3	
SGK.pas	C:\Saphire 8\Debug\source\	5	
SGKDevice.pas	C:\Saphire 8\Debug\source\	0	
SGKDriver.pas	C:\Saphire 8\Debug\source\	3	
SGKErrors.pas	C:\Saphire 8\Debug\source\	2	
SGKFill.pas	C:\Saphire 8\Debug\source\	11	
SgkFinal.pas	C:\Saphire 8\Debug\source\	1	
SGKFont.pas	C:\Saphire 8\Debug\source\	6	
SGKGraphics.pas	C:\Saphire 8\Debug\source\	4	
SGKInBios.pas	C:\Saphire 8\Debug\source\	3	
SgkInit.pas	C:\Saphire 8\Debug\source\	1	
SGKInputs.pas	C:\Saphire 8\Debug\source\	8	
SGKLine.pas	C:\Saphire 8\Debug\source\	8	
SGKMarker.pas	C:\Saphire 8\Debug\source\	2	
SGKPCX.pas	C:\Saphire 8\Debug\source\	1	
SGKSupport.pas	C:\Saphire 8\Debug\source\	1	
SGKUtil.pas	C:\Saphire 8\Debug\source\	5	
SGKWin.pas	C:\Saphire 8\Debug\source\	4	
SGMenu.pas	C:\Saphire 8\Debug\source\	7	
Simulation_Main.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
SimulationBaseObject.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
SimulationEdit_Main.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
SimulationObject.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
SortLibX.pas	C:\Saphire 8\Debug\source\	4	
SortList.pas	C:\Saphire 8\Debug\source\	8	
SortMrg.pas	C:\Saphire 8\Debug\source\	6	
Soundex.pas	C:\Saphire 8\Debug\source\	11	
Sounds.pas	C:\Saphire 8\Debug\source\	3	
SPARH.pas	C:\Saphire 8\Debug\source\DelphiSource\	7	
SPARH.pas	C:\Saphire 8\Debug\source\hfdll\	7	
SparRpt.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
SPDLib.pas	C:\Saphire 8\Debug\source\	6	
SplashScreenForm.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
SqCanvas.pas	C:\Saphire 8\Debug\source\	8	
SqCheck.pas	C:\Saphire 8\Debug\source\	5	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
SqDef.pas	C:\Saphire 8\Debug\source\	0	
SqEdDef.pas	C:\Saphire 8\Debug\source\	0	
SqEdit.pas	C:\Saphire 8\Debug\source\	6	
SqExec.pas	C:\Saphire 8\Debug\source\	6	
SqGShow.pas	C:\Saphire 8\Debug\source\	3	
SqGSmb1.pas	C:\Saphire 8\Debug\source\	4	
SqGTop.pas	C:\Saphire 8\Debug\source\	1	
SqGUtil.pas	C:\Saphire 8\Debug\source\	3	
SQLAct.pas	C:\Saphire 8\Debug\source\	25	
SQLCheck.pas	C:\Saphire 8\Debug\source\	6	
SQLExec.pas	C:\Saphire 8\Debug\source\	4	
SqLinks.pas	C:\Saphire 8\Debug\source\	4	
SQLParse.pas	C:\Saphire 8\Debug\source\	19	
SQLRun.pas	C:\Saphire 8\Debug\source\	8	
SQLScan.pas	C:\Saphire 8\Debug\source\	5	
SQLUtil.pas	C:\Saphire 8\Debug\source\	6	
SqOccur.pas	C:\Saphire 8\Debug\source\	5	
SqUtil.pas	C:\Saphire 8\Debug\source\	4	
STBackup.pas	C:\Saphire 8\Debug\source\	3	
STCustomDataSet.pas	C:\Saphire 8\Debug\source\	2	
STNative.pas	C:\Saphire 8\Debug\source\	3	
StorageX.pas	C:\Saphire 8\Debug\source\	2	
STRegistry.pas	C:\Saphire 8\Debug\source\	3	
STResourceObjects.pas	C:\Saphire 8\Debug\source\	4	
StringGridLib.pas	C:\Saphire 8\Debug\source\	5	
StringsX.pas	C:\Saphire 8\Debug\source\	4	
StrokeFont.pas	C:\Saphire 8\Debug\source\	5	
STSecurity.pas	C:\Saphire 8\Debug\source\	9	
SubUnorderedBDD.pas	C:\Saphire 8\Debug\source\DelphiSource\BddItems\	4	
SuperIO.pas	C:\Saphire 8\Debug\source\	7	
Supermsk.pas	C:\Saphire 8\Debug\source\DelphiSource\	18	
SymParse.pas	C:\Saphire 8\Debug\source\	6	
SynEdit.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	6	
SynHighlighterMacMan.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
SynHighlighterSaphL.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	3	
SynHighlighterSaphP.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	3	
SynHighlighterSaphR.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	3	
SynHighlighterSaphS.pas	C:\Saphire 8\Debug\source\DelphiSource\RulesEditor\	3	
TermX.pas	C:\Saphire 8\Debug\source\	4	
TextBase.pas	C:\Saphire 8\Debug\source\	10	
TextDB.pas	C:\Saphire 8\Debug\source\	5	
TextEd2.pas	C:\Saphire 8\Debug\source\	12	
TextEdit.pas	C:\Saphire 8\Debug\source\	6	
TextShow.pas	C:\Saphire 8\Debug\source\	10	
TextX.pas	C:\Saphire 8\Debug\source\	4	
ThorAdj.pas	C:\Saphire 8\Debug\source\	12	
ThorBld.pas	C:\Saphire 8\Debug\source\	9	
ThorEdit.pas	C:\Saphire 8\Debug\source\	11	
ThorForm.pas	C:\Saphire 8\Debug\source\	7	
ThorGraf.pas	C:\Saphire 8\Debug\source\	7	
ThorLib.pas	C:\Saphire 8\Debug\source\	9	
ThorLibX.pas	C:\Saphire 8\Debug\source\	8	
ThorLoad.pas	C:\Saphire 8\Debug\source\	8	
ThorPort.pas	C:\Saphire 8\Debug\source\	3	
ThorSer.pas	C:\Saphire 8\Debug\source\	6	
ThorShow.pas	C:\Saphire 8\Debug\source\	8	
ThorSpec.pas	C:\Saphire 8\Debug\source\	1	
ThorUtil.pas	C:\Saphire 8\Debug\source\	1	
TimeDate.pas	C:\Saphire 8\Debug\source\	4	
TimeLib.pas	C:\Saphire 8\Debug\source\	5	
TimeReal.pas	C:\Saphire 8\Debug\source\	3	
TokenLib.pas	C:\Saphire 8\Debug\source\	3	
Toolbar.pas	C:\Saphire 8\Debug\source\	10	
TPCVideo.pas	C:\Saphire 8\Debug\source\	5	
Trackit.pas	C:\Saphire 8\Debug\source\	3	
Transact.pas	C:\Saphire 8\Debug\source\	6	
TreeRiskAssessment.pas	C:\Saphire	3	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
	8\Debug\source\DelphiSource\GraphicalEditing\		
TrueTypeFont.pas	C:\Saphire 8\Debug\source\	3	
TxBLib.pas	C:\Saphire 8\Debug\source\	9	
UI_Utils.pas	C:\Saphire 8\Debug\source\DelphiSource\	9	
Uncertainty.pas	C:\Saphire 8\Debug\source\DelphiSource\	0	
UncertAreaChart.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
UniqueID.pas	C:\Saphire 8\Debug\source\DelphiSource\GraphicalEditing\	2	
Unit1.pas	C:\Saphire 8\Debug\source\DelphiSource\	1	
dummyone.pas (Unit2)	C:\Saphire 8\Debug\source\DelphiSource\	0	
dummy3.pas (Unit3)	C:\Saphire 8\Debug\source\DelphiSource\	0	
UnorderedBDD.pas	C:\Saphire 8\Debug\source\DelphiSource\BddItems\	3	
UpdLib.pas	C:\Saphire 8\Debug\source\	4	
UpgradeCats.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
UpgradeETLogic.pas	C:\Saphire 8\Debug\source\DelphiSource\	13	
Variates.pas	C:\Saphire 8\Debug\source\DelphiSource\	3	
VirtualNodeEditor.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
VRPT.pas	C:\Saphire 8\Debug\source\	0	
VRptLib.pas	C:\Saphire 8\Debug\source\	13	
VSTreeStateObj.pas	C:\Saphire 8\Debug\source\DelphiSource\	10	
VEeditors.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
WebSiteLib.pas	C:\Saphire 8\Debug\source\DelphiSource\	4	
WEditLib.pas	C:\Saphire 8\Debug\source\	11	
WinAux.pas	C:\Saphire 8\Debug\source\	3	
WinDevice.pas	C:\Saphire 8\Debug\source\	4	
Window.pas	C:\Saphire 8\Debug\source\	2	
WinDriver.pas	C:\Saphire 8\Debug\source\	5	
WinExec.pas	C:\Saphire 8\Debug\source\	6	
WinHelp.pas	C:\Saphire 8\Debug\source\	9	
WinKey.pas	C:\Saphire 8\Debug\source\	31	
WinPrint.pas	C:\Saphire 8\Debug\source\	5	
WinRebuild.pas	C:\Saphire 8\Debug\source\	9	
WinReports.pas	C:\Saphire 8\Debug\source\	9	
WinRpUtil.pas	C:\Saphire 8\Debug\source\	9	

File Name	File Path	Cyclomatic Complexity	
		v8.06.01	v8.07.17
WinSpec.pas	C:\Saphire 8\Debug\source\	0	
WinText.pas	C:\Saphire 8\Debug\source\	6	
WinTools.pas	C:\Saphire 8\Debug\source\	3	
WorkspaceUtils.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
WorkspaceUtils.pas	C:\Saphire 8\Debug\source\DelphiSource\	5	
WriteHTML.pas	C:\Saphire 8\Debug\source\DelphiSource\	2	
XmlDataGenerator.pas	C:\Saphire 8\Debug\source\	2	
XmlSchemaGenerator.pas	C:\Saphire 8\Debug\source\	2	

Figure 3-1 provides the SAPHIRE Version 8 Project Analysis using the Audits and Checks category options provided in Figure 3-2 and Figure 3-3. The analysis parses all source files into an internal tree to ensure that all symbols are available to be cross referenced and validated. The analysis results provide information on the following:

- Parsing errors
- Delphi directive names used as identifiers
- Delphi keywords used as identifiers
- Identifiers hiding others of the same name at a higher scope
- “if” statements followed by an empty statement
- Type assignment incompatibilities
- Undefined function return values
- Uninitialized variables
- Unreferenced global identifiers
- Unreferenced local identifiers
- Unused assigned values

The following provide the definitions for the messages as a result of the analysis:

A1001 Audit result message – The <item> is declared as deprecated.

A1002 Audit result message – The identifier <id> is also a Delphi directive.

A1003 Audit result message – The <item> is declared as experimental.

A1004 Audit result message – The <item> hides the <item> of the same name declared on line <n> of <filename>.

A1005 Audit result message – The identifier <id> is also a Delphi Keyword.

A1006 Audit result message – The <item> is declared as library dependent.

A1007 Audit result message – The <item> is declared as platform dependent.

C1001 Check result message – The array index expression can be outside the bounds of the array.

C1002 Check result message – The destination of the assignment is a constant so should not be modified.

C1003 Check result message – The “if” statement is followed by an empty statement.

C1004 Check result message – The constant expression is outside the range of valid values.

C1005 Check result message – The type <type> and <type> are not compatible.

C1006 Check result message – The return value of <function> is undefined in one or more code paths through its implementation.

C1007 Check result message – The <item> has not been assigned a value in one or more code paths.

C1008 Check result message – The source code at or before <item> is unreachable.

C1009 Check result message – The global <item> is declared but is never referenced.

C1010 Check result message – The local <item> is declared but is never referenced.

C1011 Check result message – The value assigned to <id> is never used.

To access the file contents shown in Figure 7-1, refer to file “*SAPHIRE8-Analysis-100405.pdf*” included on the CD as an addendum to this report. To access the file:

1. Open Internet Explorer.
2. Select “Open” from the “File” menu.
3. The “Open” window will be displayed.
4. Select the “Browse...” button from the “Open” window.
5. The “Windows Internet Explorer” window will be displayed.
6. Navigate to the “*SAPHIRE8-Analysis-100405.pdf*” file located on the CD.
7. Select the “*SAPHIRE8-Analysis-100405.pdf*” file on the CD.
8. Select the “Open” button from the “Windows Internet Explorer” window.
9. The “Windows Internet Explorer” window will close.
10. Select the “OK” button from the “Open” window.

Figure 3-1 Source Code Analysis for CodeHealer SAPHIRE 8 v8.06.01

Figure 3-2 Audits Category for CodeHealer Project SAPHIRE 8 Analysis

Figure 3-3 Checks Category Settings for CodeHealer Project SAPHIRE 8 Analysis

3.2 Coverage Validator

Coverage Validator by Software Verification, Copyright Object Media Limited © 2002-2006. Coverage Validator is an automatic source code coverage analyzer for Windows NT® 4.0 and above, running on the Intel i386 (and compatible) family of processors. Coverage Validator automatically detects which lines of your program have been executed, provides visit counts for each line and calculates visit percentages for files that are visited. Coverage Validator places a very low overhead on the performance of your application and does not require the target program to be recompiled or relinked. Coverage Validator can also be used for unit testing and as part of a regression testing strategy used by Quality Assurance teams.

3.2.1 Coverage Validator Results

Version 8.06.1 was used to run an SDP, ECA and GA in the IV&V effort. We will run the same analyses types for v8.07.17 and present both of the results for the metrics report.

Figure 8-1, Figure 8-2 and Figure 8-3 provides the coverage summary for the SAPHIRE version 8 source code using the source code coverage analyzer *Coverage Validator* © Version 4.10. The coverage summary for a Significance Determination Process analysis (Figure 8-1), Events and Condition Assessment analysis (Figure 8-2) and a General analysis (Figure 8-3) have been provided.

The figures show various coverage statistics with percentages where appropriate. No unit testing has been performed. The statistics displayed are:

- Number of files
- Number of visited files
- Number of unvisited files
- Number of 100% visited files

- Number of functions
- Number of visited functions
- Number of unvisited functions
- Number of 100% visited functions

- Number of branches
- Number of visited branches
- Number of unvisited branches
- Number of functions containing branches
- Number of 100% branch functions

- Number of lines
 - Number of visited lines
 - Number of unvisited lines
 - Number of lines that could not be hooked
 - Number of visits to lines
-
- Number of unit tests
 - Number of successful unit tests
 - Number of unsuccessful unit tests
 - Number of unit test failures
 - Number of unit test errors

3.3 Memory Validator

Memory Validator by Software Verification, Copyright Object Media Limited © 2002-2006. Memory Validator is an advanced memory and resource leak detector for Windows NT® 4.0 and above, running on the Intel i386 (and compatible) family of processors. Memory Validator detects memory leaks, handle leaks, memory corruptions, uninitialized memory, buffer overruns and buffer under runs. Memory Validator is fast and does not require the target program to be recompiled or relinked. Memory Validator can also be used to detect performance problems related to memory and resource allocation and deallocation, and performance problems related to fragmented memory heaps. Memory Validator tracks the C runtime heaps, Win32 heaps, GlobalAlloc and LocalAlloc heaps, VirtualAlloc heaps, Win32 resource handles and COM object creation and destruction.

3.3.1 Memory Validator Results

Figure 3-4 provides the results for memory leak and handle leak detection for the SAPHIRE version 8 source code v8.06.01 using the memory and resource leak detector *Memory Validator* © Version 4.86. The option “*Check pointers and handles on DWORD boundaries. Fastest option. This will find less pointers and handles, but also find less FALSE positives*” was selected for the results provided.

Figure 3-4 Memory Validator Memory Leak and Handle Leak Detection v8.06.01

Figure 3-5 provides the results for memory leak and handle leak detection for the SAPHIRE version 8 source code v8.07.17 using the memory and resource leak detector *Memory Validator* © Version 4.86.

Figure 3-5 Memory Validator Memory Leak and Handle Leak Detection v8.07.17

3.4 Performance Validator

Performance Validator by Software Verification, Copyright Object Media Limited © 2002-2006. Performance Validator is an automatic performance analyzer for Windows NT® 4.0 and above, running on the Intel i386 (and compatible) family of processors. Performance Validator automatically calculates performance data for your application as it executes. Performance Validator places a very low overhead on the performance of your application and does not require the target program to be recompiled or relinked. Performance Validator can also be used for unit testing and as part of a regression testing strategy used by Quality Assurance teams.

3.4.1 Performance Validator Results

Figure 3-6 through Figure 3-11 provides partial results for the performance statistics for the SAPHIRE version 8 source code using the performance analyzer *Performance Validator* © Version 2.63. The performance statistics for a Significance Determination Process analysis (Figure 3-6 and Figure 3-7), Events and Condition Assessment analysis (Figure 3-8 and Figure 3-9) and a General analysis (Figure 3-10 and Figure 3-11) have been provided.

The figures show various performance statistics with percentages where appropriate. The statistics displayed are:

Number of Children – The number of child functions of a function.

Address – The function address.

Class – The class name.

Method / Function Name – The method/function name.

File Name – The file name.

Module Name – The module name.

Call Count – The number of times the function is called.

Call Count% - The number of times the function is called.

Function Time – The time a function takes to execute.

Function Time% - The time a function takes to execute.

Total Time – The time a function and its child functions take to execute.

Total Time% - The time a function and its child functions take to execute.

Average Time – The average time a function takes to execute.

Average Time% - The average time a function takes to execute.

Child Time – The time a function's child functions take to execute.

Child Time% - The time a function's child functions take to execute.

Longest Time – The longest time a function and its child functions take to execute.

Longest Time% - The longest time a function and its child functions take to execute.

Shortest Time – The shortest time a function and its child functions take to execute.

Shortest Time% - The shortest time a function and its child functions take to execute.

This report identifies functions and methods that are taking the most time, or which are visited more than other functions.

Performance Validator SDF Statistics Report - statistics - Windows Internet Explorer provided by Idaho National Laboratory

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Performance Validator\PerformanceValidatorSDFStatisticsReport.html

Performance Validator SDF Statistics Report - statistics

Application tested: SAPHIRE.exe
 Description: Performance Validator SDF Statistics Report
 Statistics generated on February 15 2010 14:44:25 using [Performance Validator 2.63 by Software Verification](#)

Num Children	Address	Class	Method	Module	Filename	Function	Function %	Av Func	Av Func %	Chil
0	0x009045c4	JvTimer.ThreadClosed		saphire.exe	mxCaptionBarButtons.pas Line 1701	0	0.00	0	0.00	
0	0x00404a08	System.@FindDynInst		saphire.exe	system.pas Line 9207	0	0.00	0	0.00	
1	0x00904894	JvTimer.TJvTimer.Synchronize		saphire.exe	mxCaptionBarButtons.pas Line 1701	0	0.00	0	0.00	
1	0x00439ad0	Classes.TThread.Synchronize		saphire.exe	classes.pas Line 10181	0	0.00	0	0.00	
5	0x00439934	Classes.TThread.Synchronize		saphire.exe	classes.pas Line 10123	946	0.15	0	0.00	
3	0x00404b58	System.@ClassCreate		saphire.exe	system.pas Line 9484	0	0.00	0	0.00	
3	0x0040478c	System.TObject.NewInstance		saphire.exe	system.pas Line 8823	1	0.00	0	0.00	
0	0x004047bc	System.TObject.InstanceSize		saphire.exe	system.pas Line 8835	0	0.00	0	0.00	
2	0x004019a0	System.SysGetMem		saphire.exe	GETMEM.INC Line 1458	2	0.00	0	0.00	
0	0x00404800	System.TObject.InitInstance		saphire.exe	system.pas Line 8878	0	0.00	0	0.00	
4	0x00404bb0	System.@AfterConstruction		saphire.exe	system.pas Line 9535	0	0.00	0	0.00	
3	0x0042c55c	Classes.TList.Add		saphire.exe	classes.pas Line 2917	0	0.00	0	0.00	
1	0x0042c838	Classes.TList.Grow		saphire.exe	classes.pas Line 3004	0	0.00	0	0.00	
3	0x0042cbcc	Classes.TList.SetCapacity		saphire.exe	classes.pas Line 3131	1	0.00	0	0.00	
0	0x0042ce38	Classes.TList.Notify		saphire.exe	classes.pas Line 3209	0	0.00	0	0.00	
0	0x004392b4	Classes.SignalSyncEvent		saphire.exe	classes.pas Line 9779	0	0.00	0	0.00	
0	0x004c186c	Forms.TApplication.WakeMainThread		saphire.exe	Forms.pas Line 8598	3	0.00	0	0.00	
1	0x0040585c	System.@LStrArrayClr		saphire.exe	system.pas Line 12267	0	0.00	0	0.00	
2	0x004bfa6c	Forms.TApplication.HandleMessage		saphire.exe	Forms.pas Line 7688	0	0.00	0	0.00	12
8	0x004bf900	Forms.TApplication.ProcessMessage		saphire.exe	Forms.pas Line 7647	1	0.00	0	0.00	11
2	0x004c18c4	Forms.TApplication.IsPreProcessMessage		saphire.exe	Forms.pas Line 8616	0	0.00	0	0.00	
0	0x00498f18	Controls.FindControl		saphire.exe	Controls.pas Line 2097	0	0.00	0	0.00	
3	0x004bf740	Forms.TApplication.IsHintMsg		saphire.exe	Forms.pas Line 7602	0	0.00	0	0.00	
0	0x004a95fc	Controls.THintWindow.IsHintMsg		saphire.exe	Controls.pas Line 9765	0	0.00	0	0.00	
0	0x004bf570	Forms.TApplication.IsMDIMsg		saphire.exe	Forms.pas Line 7552	0	0.00	0	0.00	

Done

My Computer 100%

Figure 3-6 SAPHIRE 8 v8.06.01 Performance Validator SDP Statistics Report - Left

Performance Validator SDF Statistics Report - statistics - Windows Internet Explorer provided by Idaho National Laboratory

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Performance Validator\PerformanceValidatorSDFStatisticsReport.html

Performance Validator SDF Statistics Report - statistics

Verification

	Module	Filename	Function	Function %	Av Func	Av Func %	Children	Children %	Call Count	Call Count %	Total	Total %	Longest	Longest %	Shortest	Shortest %
	saphire.exe	mxCaptionBarButtons.pas Line 1701		0 0.00		0 0.00		0 0.00	52,270	0.30		0 0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 9207		0 0.00		0 0.00		0 0.00	26,157	0.15		0 0.00		0 0.00		0 0.00
	saphire.exe	mxCaptionBarButtons.pas Line 1701		0 0.00		0 0.00	955	0.15	26,135	0.15	955	0.15	191	0.03		0 0.00
	saphire.exe	classes.pas Line 10181		0 0.00		0 0.00	955	0.15	26,135	0.15	955	0.15	191	0.03		0 0.00
	saphire.exe	classes.pas Line 10123		946 0.15		0 0.00	8	0.00	26,135	0.15	955	0.15	191	0.03		0 0.00
	saphire.exe	system.pas Line 9484		0 0.00		0 0.00	2	0.00	40,330	0.23	3	0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 8823		1 0.00		0 0.00	1	0.00	40,330	0.23	2	0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 8835		0 0.00		0 0.00		0 0.00	40,330	0.23		0 0.00		0 0.00		0 0.00
	saphire.exe	GETMEM.INC Line 1458		2 0.00		0 0.00		0 0.00	134,128	0.76	2	0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 8878		0 0.00		0 0.00		0 0.00	40,330	0.23		0 0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 9535		0 0.00		0 0.00		0 0.00	40,329	0.23		0 0.00		0 0.00		0 0.00
	saphire.exe	classes.pas Line 2917		0 0.00		0 0.00	1	0.00	35,550	0.20	2	0.00		0 0.00		0 0.00
	saphire.exe	classes.pas Line 3004		0 0.00		0 0.00	1	0.00	31,124	0.18	1	0.00		0 0.00		0 0.00
	saphire.exe	classes.pas Line 3131		1 0.00		0 0.00		0 0.00	73,732	0.42	2	0.00		0 0.00		0 0.00
	saphire.exe	classes.pas Line 3209		0 0.00		0 0.00		0 0.00	82,981	0.47		0 0.00		0 0.00		0 0.00
	saphire.exe	classes.pas Line 9779		0 0.00		0 0.00		0 0.00	26,135	0.15		0 0.00		0 0.00		0 0.00
	saphire.exe	Forms.pas Line 8598		3 0.00		0 0.00		0 0.00	26,135	0.15	3	0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 12267		0 0.00		0 0.00		0 0.00	48,668	0.27		0 0.00		0 0.00		0 0.00
	saphire.exe	Forms.pas Line 7688		0 0.00		0 0.00	12,527	2.01	13,027	0.07	12,527	2.01	10,945	1.76		0 0.00
	saphire.exe	Forms.pas Line 7647		1 0.00		0 0.00	11,190	1.80	13,746	0.08	11,192	1.80	10,945	1.76		0 0.00
	saphire.exe	Forms.pas Line 8616		0 0.00		0 0.00		0 0.00	7,471	0.04		0 0.00		0 0.00		0 0.00
	saphire.exe	Controls.pas Line 2097		0 0.00		0 0.00		0 0.00	35,839	0.20		0 0.00		0 0.00		0 0.00
	saphire.exe	Forms.pas Line 7602		0 0.00		0 0.00		0 0.00	7,471	0.04		0 0.00		0 0.00		0 0.00
	saphire.exe	Controls.pas Line 9765		0 0.00		0 0.00		0 0.00	7,471	0.04		0 0.00		0 0.00		0 0.00
	saphire.exe	Forms.pas Line 7552		0 0.00		0 0.00		0 0.00	7,471	0.04		0 0.00		0 0.00		0 0.00

Done

My Computer 100%

Figure 3-7 SAPHIRE 8 v8.06.01 Performance Validator SDP Statistics Report - Right

Performance Validator ECA Statistics Report - statistics - Windows Internet Explorer provided by Idaho National Laboratory

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Performance Validator\PerformanceValidatorECAStatisticsReport.html

Performance Validator ECA Statistics Report - statistics

Application tested: SAPHIRE.exe
 Description: Performance Validator ECA Statistics Report
 Statistics generated on February 15 2010 16:51:59 using [Performance Validator 2.63 by Software Verification](#)

Num Children	Address	Class	Method	Module	Filename	Function	Function %	Av Func	Av Func %
0	0x009045c4		JvTimer.ThreadClosed	saphire.exe	mxCaptionBarButtons.pas Line 1701	0	0.00	0	0.00
0	0x00404a08		System.@FindDynInst	saphire.exe	system.pas Line 9207	0	0.00	0	0.00
4	0x00904894		JvTimer.TJvTimer.Synchronize	saphire.exe	mxCaptionBarButtons.pas Line 1701	0	0.00	0	0.00
1	0x00439ad0		Classes.TThread.Synchronize	saphire.exe	classes.pas Line 10181	0	0.00	0	0.00
5	0x00439934		Classes.TThread.Synchronize	saphire.exe	classes.pas Line 10123	2,823	0.87	0	0.00
2	0x00404b58		System.@ClassCreate	saphire.exe	system.pas Line 9484	0	0.00	0	0.00
3	0x0040478c		System.TObject.NewInstance	saphire.exe	system.pas Line 8823	1	0.00	0	0.00
0	0x004047bc		System.TObject.InstanceSize	saphire.exe	system.pas Line 8835	0	0.00	0	0.00
3	0x004019a0		System.SysGetMem	saphire.exe	GETMEM.INC Line 1458	10	0.00	0	0.00
0	0x00404800		System.TObject.InitInstance	saphire.exe	system.pas Line 8878	0	0.00	0	0.00
4	0x00404bb0		System.@AfterConstruction	saphire.exe	system.pas Line 9535	0	0.00	0	0.00
3	0x0042c55c		Classes.TList.Add	saphire.exe	classes.pas Line 2917	0	0.00	0	0.00
1	0x0042c838		Classes.TList.Grow	saphire.exe	classes.pas Line 3004	0	0.00	0	0.00
3	0x0042cbcc		Classes.TList.SetCapacity	saphire.exe	classes.pas Line 3131	0	0.00	0	0.00
0	0x0042ce38		Classes.TList.Notify	saphire.exe	classes.pas Line 3209	0	0.00	0	0.00
0	0x004392b4		Classes.SignalSyncEvent	saphire.exe	classes.pas Line 9779	0	0.00	0	0.00
0	0x004c186c		Forms.TApplication.WakeMainThread	saphire.exe	Forms.pas Line 8598	1	0.00	0	0.00
1	0x0040585c		System.@LStrArrayClr	saphire.exe	system.pas Line 12267	3	0.00	0	0.00
3	0x004bfa6c		Forms.TApplication.HandleMessage	saphire.exe	Forms.pas Line 7688	0	0.00	1	0.00
8	0x004bf900		Forms.TApplication.ProcessMessage	saphire.exe	Forms.pas Line 7647	0	0.00	1	0.00
2	0x004c18c4		Forms.TApplication.IsPreProcessMessage	saphire.exe	Forms.pas Line 8616	0	0.00	0	0.00
0	0x00498f18		Controls.FindControl	saphire.exe	Controls.pas Line 2097	0	0.00	0	0.00
3	0x004bf740		Forms.TApplication.IsHintMsg	saphire.exe	Forms.pas Line 7602	0	0.00	0	0.00
0	0x004a95fc		Controls.THintWindow.IsHintMsg	saphire.exe	Controls.pas Line 9765	0	0.00	0	0.00
0	0x004bf570		Forms.TApplication.IsMDIMsg	saphire.exe	Forms.pas Line 7552	0	0.00	0	0.00

Done

My Computer 100%

Figure 3-8 SAPHIRE 9 v8.06.01 Performance Validator ECA Statistics Report - Left

Performance Validator ECA Statistics Report - statistics - Windows Internet Explorer provided by Idaho National Laboratory

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Performance Validator\PerformanceValidatorECAStatisticsReport.html

Performance Validator ECA Statistics Report - statistics

ification

	Module	Filename	Function	Function %	Av Func	Av Func %	Children	Children %	Call Count	Call Count %	Total	Total %	Longest	Longest %	Shortest	Shortest %
	saphire.exe	mxCaptionBarButtons.pas Line 1701		0 0.00		0 0.00		0 0.00	11,561	0.04		0 0.00		0 0.00		0 0.00
	saphire.exe	system.pas Line 9207		0 0.00		0 0.00		0 0.00	5,802	0.02		0 0.00		0 0.00		0 0.00
	saphire.exe	mxCaptionBarButtons.pas Line 1701		0 0.00		0 0.00	5,486	1.69	5,781	0.02	5,486	1.69	476	0.15		0 0.00
	saphire.exe	classes.pas Line 10181		0 0.00		0 0.00	2,826	0.87	5,781	0.02	2,826	0.87	476	0.15		0 0.00
	saphire.exe	classes.pas Line 10123		2,823 0.87		0 0.00	2 0.00		5,781	0.02	2,826	0.87	476	0.15		0 0.00
	saphire.exe	system.pas Line 9484		0 0.00		0 0.00	2 0.00		35,456	0.11	2 0.00		0 0.00			0 0.00
	saphire.exe	system.pas Line 8823		1 0.00		0 0.00	1 0.00		35,456	0.11	2 0.00		0 0.00			0 0.00
	saphire.exe	system.pas Line 8835		0 0.00		0 0.00	0 0.00		35,456	0.11	0 0.00		0 0.00			0 0.00
	saphire.exe	GETMEM.INC Line 1458		10 0.00		0 0.00	0 0.00		537,363	1.74	10 0.00		0 0.00			0 0.00
	saphire.exe	system.pas Line 8878		0 0.00		0 0.00	0 0.00		35,456	0.11	0 0.00		0 0.00			0 0.00
	saphire.exe	system.pas Line 9535		0 0.00		0 0.00	39 0.01		35,456	0.11	40 0.01		20 0.01			0 0.00
	saphire.exe	classes.pas Line 2917		0 0.00		0 0.00	1 0.00		23,445	0.08	1 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 3004		0 0.00		0 0.00	0 0.00		13,372	0.04	0 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 3131		0 0.00		0 0.00	0 0.00		30,913	0.10	1 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 3209		0 0.00		0 0.00	0 0.00		54,569	0.18	0 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 9779		0 0.00		0 0.00	0 0.00		5,781	0.02	0 0.00		0 0.00			0 0.00
	saphire.exe	Forms.pas Line 8598		1 0.00		0 0.00	0 0.00		5,781	0.02	1 0.00		0 0.00			0 0.00
	saphire.exe	system.pas Line 12267		3 0.00		0 0.00	0 0.00		326,362	1.06	3 0.00		0 0.00			0 0.00
	saphire.exe	Forms.pas Line 7688		0 0.00		1 0.00	5,886	1.82	4,758	0.02	5,886	1.82	5,410	1.67		0 0.00
	saphire.exe	Forms.pas Line 7647		0 0.00		1 0.00	5,481	1.69	5,011	0.02	5,482	1.69	5,410	1.67		0 0.00
	saphire.exe	Forms.pas Line 8616		0 0.00		0 0.00	0 0.00		3,055	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Controls.pas Line 2097		0 0.00		0 0.00	0 0.00		14,610	0.05	0 0.00		0 0.00			0 0.00
	saphire.exe	Forms.pas Line 7602		0 0.00		0 0.00	0 0.00		3,055	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Controls.pas Line 9765		0 0.00		0 0.00	0 0.00		3,055	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Forms.pas Line 7552		0 0.00		0 0.00	0 0.00		3,055	0.01	0 0.00		0 0.00			0 0.00

My Computer 100%

Figure 3-9 SAPHIRE 8 v8.06.01 Performance Validator ECA Statistics Report - Right

Performance Validator General Analysis Statistics Report Options - statistics - Windows Internet Explorer provided by Idaho Nat

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Performance Validator\PerformanceValidatorGeneralAnalysisStatisticsReportOptions.html

Performance Validator General Analysis Statistics Rep...

Application tested: SAPHIRE.exe
Description: Performance Validator General Analysis Statistics Report Options
Statistics generated on February 19 2010 12:16:00 using [Performance Validator 2.63 by Software Verification](#)

Num Children	Address	Class	Method	Module	Filename	Function	Function %	Av Func	Av Func %	Children	C
2	0x0081440c		ActnMenus.CallWndHook	saphire.exe	ActnMenus.pas Line 696	1	0.00	0	0.00	0	0
6	0x0043bbb8		Classes.StdWndProc	saphire.exe	classes.pas Line 11564	0	0.00	0	0.00	4,834	2
14	0x004a370c		Controls.TWinControl.MainWndProc	saphire.exe	Controls.pas Line 7018	2	0.00	0	0.00	4,801	2
14	0x009031ac		mxCaptionBarButtons.TmxCaptionBarButtons.MyWindowProc	saphire.exe	mxCaptionBarButtons.pas Line 1146	2	0.00	0	0.00	3,697	1
0	0x00903110		mxCaptionBarButtons.TmxCaptionBarButtons.GetItems	saphire.exe	mxCaptionBarButtons.pas Line 1120	0	0.00	0	0.00	0	0
0	0x0042e890		Classes.TCollection.GetCount	saphire.exe	classes.pas Line 4082	0	0.00	0	0.00	0	0
1	0x00902c58		mxCaptionBarButtons.TmxCaptionButtons.GetButton	saphire.exe	mxCaptionBarButtons.pas Line 989	0	0.00	0	0.00	0	0
1	0x0042e8ac		Classes.TCollection.GetItem	saphire.exe	classes.pas Line 4087	2	0.00	0	0.00	0	0
0	0x0042c7f0		Classes.TList.Get	saphire.exe	classes.pas Line 2990	13	0.01	0	0.00	0	0
1	0x00901e60		mxCaptionBarButtons.TmxCaptionButton.HitTest	saphire.exe	mxCaptionBarButtons.pas Line 619	0	0.00	0	0.00	0	0
1	0x004a9690		Controls.THintWindow.ReleaseHandle	saphire.exe	Controls.pas Line 9775	0	0.00	0	0.00	0	0
9	0x004a3328		Controls.TWinControl.DestroyHandle	saphire.exe	Controls.pas Line 6915	0	0.00	0	0.00	0	0
1	0x004b5d1c		Forms.TCustomForm.WndProc	saphire.exe	Forms.pas Line 3159	0	0.00	0	0.00	3,687	1
16	0x004a3bb4		Controls.TWinControl.WndProc	saphire.exe	Controls.pas Line 7141	1	0.00	0	0.00	5,293	2
3	0x0049eff4		Controls.TControl.WndProc	saphire.exe	Controls.pas Line 5060	2	0.00	0	0.00	5,291	2
198	0x00404a50		System.TObject.Dispatch	saphire.exe	system.pas Line 9293	1	0.00	0	0.00	5,286	2
1	0x004b95b4		Forms.TCustomForm.WMNCHitTest	saphire.exe	Forms.pas Line 4603	0	0.00	0	0.00	0	0
2	0x004a61d0		Controls.TWinControl.WMNCHitTest	saphire.exe	Controls.pas Line 8175	0	0.00	0	0.00	0	0
1	0x004b87fc		Forms.TCustomForm.DefaultHandler	saphire.exe	Forms.pas Line 4258	0	0.00	0	0.00	96	0
13	0x004a408c		Controls.TWinControl.DefaultHandler	saphire.exe	Controls.pas Line 7250	8	0.00	0	0.00	4,159	1
6	0x0049b234		Controls.FreeDeviceContexts	saphire.exe	Controls.pas Line 3313	2	0.00	0	0.00	1	0
0	0x0042d314		Classes.TThreadList.LockList	saphire.exe	classes.pas Line 3342	1	0.00	0	0.00	0	0
0	0x0042d390		Classes.TThreadList.UnlockList	saphire.exe	classes.pas Line 3358	1	0.00	0	0.00	0	0

My Computer 100%

Figure 3-10 SAPHIRE 8 v8.06.01 Performance Validator General Analysis Statistics Report - Left

Performance Validator General Analysis Statistics Report Options - statistics - Windows Internet Explorer provided by Idaho Nat

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Performance Validator\PerformanceValidatorGeneralAnalysisStatisticsReportOptions.html

Performance Validator General Analysis Statistics Rep...

Software Verification

	Module	Filename	Function	Function %	Av Func	Av Func %	Children	Children %	Call Count	Call Count %	Total	Total %	Longest	Longest %	Shortest	Shortest %
	saphire.exe	ActnMenus.pas Line 696		1 0.00	0 0.00		0 0.00		117,233	0.33	1 0.00		0 0.00		0 0.00	
	saphire.exe	classes.pas Line 11564		0 0.00	0 0.00		4,834	2.01	128,699	0.36	4,835	2.01	3,484	1.45		0 0.00
	saphire.exe	Controls.pas Line 7018		2 0.00	0 0.00		4,801	2.00	109,450	0.31	4,804	2.00	3,484	1.45		0 0.00
MyWindowProc	saphire.exe	mxCaptionBarButtons.pas Line 1146		2 0.00	0 0.00		3,697	1.54	25,251	0.07	3,699	1.54	3,482	1.45		0 0.00
GetItems	saphire.exe	mxCaptionBarButtons.pas Line 1120		0 0.00	0 0.00		0 0.00		84,391	0.24	0 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 4082		0 0.00	0 0.00		0 0.00		134,074	0.38	0 0.00		0 0.00			0 0.00
button	saphire.exe	mxCaptionBarButtons.pas Line 989		0 0.00	0 0.00		0 0.00		56,597	0.16	1 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 4087		2 0.00	0 0.00		0 0.00		220,974	0.62	2 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 2990		13 0.01	0 0.00		0 0.00		3,355,449	9.42	13 0.01		0 0.00			0 0.00
st	saphire.exe	mxCaptionBarButtons.pas Line 619		0 0.00	0 0.00		0 0.00		4,412	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Controls.pas Line 9775		0 0.00	0 0.00		0 0.00		3,932	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Controls.pas Line 6915		0 0.00	0 0.00		0 0.00		4,185	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Forms.pas Line 3159		0 0.00	0 0.00		3,687	1.54	25,910	0.07	3,687	1.54	3,482	1.45		0 0.00
	saphire.exe	Controls.pas Line 7141		1 0.00	0 0.00		5,293	2.20	155,181	0.44	5,295	2.20	3,484	1.45		0 0.00
	saphire.exe	Controls.pas Line 5060		2 0.00	0 0.00		5,291	2.20	165,898	0.47	5,293	2.20	3,484	1.45		0 0.00
	saphire.exe	system.pas Line 9293		1 0.00	0 0.00		5,286	2.20	166,030	0.47	5,287	2.20	3,484	1.45		0 0.00
	saphire.exe	Forms.pas Line 4603		0 0.00	0 0.00		0 0.00		2,262	0.01	0 0.00		0 0.00			0 0.00
	saphire.exe	Controls.pas Line 8175		0 0.00	0 0.00		0 0.00		45,950	0.13	1 0.00		0 0.00			0 0.00
	saphire.exe	Forms.pas Line 4258		0 0.00	0 0.00		96 0.04		16,343	0.05	96 0.04		4 0.00			0 0.00
	saphire.exe	Controls.pas Line 7250		8 0.00	0 0.00		4,159	1.73	104,280	0.29	4,168	1.74	3,484	1.45		0 0.00
	saphire.exe	Controls.pas Line 3313		2 0.00	0 0.00		1 0.00		109,559	0.31	4 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 3342		1 0.00	0 0.00		0 0.00		297,826	0.84	1 0.00		0 0.00			0 0.00
	saphire.exe	classes.pas Line 3358		1 0.00	0 0.00		0 0.00		297,826	0.84	1 0.00		0 0.00			0 0.00

My Computer 100%

Figure 3-11 SAPHIRE 8 v8.06.01 Performance Validator General Analysis Statistics Report - Right

3.5 Thread Validator

Thread Validator by Software Verification, Copyright Object Media Limited © 2003-2006. Thread Validator is an automatic deadlock detector for Windows NT® 4.0 and above, running on the Intel i386 (and compatible) family of processors. Thread Validator detects deadlocks, potential deadlocks, bad lock strategies, and performs deadlock postmortem analysis. Thread Validator places a very low overhead on the performance of your application and does not require the target program to be recompiled or relinked.

3.5.1 Thread Validator Results

Figure 3-13, Figure 3-14 and Figure 3-15 provide the deadlocks, potential deadlocks, bad lock strategies, and deadlock postmortem analysis for the SAPHIRE version 8 source code using the deadlock detector *Thread Validator* Version 1.52. The partial results of deadlocks, potential deadlocks, bad lock strategies, and deadlock postmortem analysis for a Significance Determination Process analysis (Figure 3-13), Events and Condition Assessment analysis (Figure 3-14) and a General analysis (Figure 3-15) have been provided. Figure 8-16 provides the color code definitions for the memory and resource allocations that have not been de-allocated and any information about damaged memory presented in Figure 3-13 through Figure 3-15.

Figure 3-12 Thread Validator Lock Colors Definitions

Figure 3-13 through Figure 3-15 provide the following information about all memory and resource allocations that have not been deallocated and any information about damaged memory:

The first column provides the Critical Section Address.

The second column provides the Entered Count.

The third column provides the Recursion Count, the number of times the critical section has been re-entered while locked by the current thread.

The fourth column provides the Contended Count, the number of times that a thread has tried to acquire the critical section but has had to wait because another thread already owns the critical section.

The fifth column provides the Number of Waiting Processor Cycles.

The sixth column provides the Thread Id.

The seventh column provides the Number of Waiting Threads.

The eighth column provides the Location Where the Object Was Allocated, Locked or Waiting.

SAPHIRE.exe - Windows Internet Explorer provided by Idaho National Laboratory

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Thread Validator\ThreadValidatorSDPReport.html

SAPHIRE.exe

Critical Sections and Waits

0x000006c8	Wait Single	timeout: Infinite	-	114,006ms	1904	StateWait (UserRequest)	0x1a2e6d7b : ACEHasFeature
0x00159208	9,368,278	0	0	-	-	-	Allocated memory or stack space
0x1925d260	233,396	992	10	0	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x039a8ab0	54,085	0	30	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x039a8934	38,378	0	8	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1925cfc4	35,491	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x039a8bfc	19,936	23	47	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1a64dc38	19,910	8,634	82	0	-	-	Allocated memory or stack space
0x1925ceb4	18,259	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x19f8fc44	13,323	0	3	0	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x039a8a20	10,350	0	2	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1a24aeac	9,129	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll
0x1925ced8	4,844	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x039a89e4	4,575	102	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x039a8a44	4,521	103	1	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x039a8a08	4,517	102	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1abdf018	4,184	0	0	-	-	-	Allocated memory or stack space
0x1b6cdef0	3,490	8	0	-	-	-	Allocated memory or stack space
0x19f8fc2c	2,584	0	4	0	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x039a8ad4	2,228	176	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1a24a650	1,962	874	0	-	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll
0x19fb486c	1,819	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x1a24afac	1,670	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll
0x1a82b8cc	1,492	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\sqlite.dll
0x03c83bc8	1,442	721	0	-	-	-	c:\windows\winsxs\x86_microsoft.vc80.crt_1fc8b3b9a1e18e3b_8.0.50727.762_x-ww_6b128700\msvcr80.dll

Done

My Computer 100%

Figure 3-13 SAPHIRE 8 v8.06.01 Thread Validator SDP Critical Sections and Waits Report

SAPHIRE.exe - Windows Internet Explorer provided by Idaho National Laboratory

File Edit View Favorites Tools Help

C:\Program Files\Software Verification\Thread Validator\ThreadValidatorECAReport.html

SAPHIRE.exe

Critical Sections and Waits

0x00000698	Wait Single	timeout:Infinite	-	47,026,369ms	6140	StateWait (UserRequest)	0x19ae6d7b : ACEHasFeature
0x00159208	46,480,854	0	0	-	-	-	Allocated memory or stack space
0x18a5d260	31,134,745	1,123	5	0	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x18a5cfc4	9,995,464	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x18a5ceb4	4,849,360	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x19e4dc38	3,455,724	1,477,598	2	0	-	-	Allocated memory or stack space
0x1ab3f018	3,005,905	0	0	-	-	-	Allocated memory or stack space
0x01e08ab0	54,083	0	5	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x01e08934	31,039	0	1	8	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x01e08bfc	20,390	24	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1978fc44	19,257	0	2	0	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x01e08a20	10,385	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x19a4a650	6,911	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll
0x18a5ced8	4,844	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x1978fc2c	3,518	0	1	0	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x01e089e4	3,300	135	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x01e08a44	3,236	135	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x01e08a08	3,232	134	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x197b486c	3,172	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x24624840	2,226	8	0	-	-	-	Allocated memory or stack space
0x01e08ad4	2,082	151	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x19a4a650	1,897	833	1	1	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll
0x01d9b8cc	1,492	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\sqlite.dll
0x179d3bc8	1,430	715	0	-	-	-	c:\windows\winsxs\x86_microsoft.vc80.crt_1fc8b3b9a1e18e3b_8.0.50727.762_x-ww_6b128700\msvcr80.dll
0x19a4afac	1,232	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll

Done

My Computer 100%

Figure 3-14 SAPHIRE 8 v8.06.01 Thread Validator ECA Critical Sections and Waits Report

SAPHIRE.exe - Windows Internet Explorer provided by Idaho National Laboratory

C:\Program Files\Software Verification\Thread Validator\ThreadValidatorGeneralAnalysisReport.html

Critical Sections and Waits

numObjects:2	Wait Multiple	timeout:Infinite	0:0x00000ae4 1:0x00000ad0	558,341ms	2088	StateWait (UserRequest)	0x72d2312a : midMessage
0x00159208	55,706,048	0	0	-	-	-	Allocated memory or stack space
0x18a5d260	31,134,745	1,123	5	0	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x18a5cfc4	9,995,464	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x18a5ceb4	4,849,360	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x19e4dc38	3,455,724	1,477,598	2	0	-	-	Allocated memory or stack space
0x1ab3f018	3,005,905	0	0	-	-	-	Allocated memory or stack space
0x30dcd260	659,356	972	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x3dd2dac0	291,399	0	0	-	-	-	c:\windows\system32\mshtml.dll
0x30dccc4	138,578	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x188b8ab0	92,356	0	5	0	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x041a1738	62,723	16,087	0	-	-	-	Allocated memory or stack space
0x188b8934	54,884	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x01e08ab0	54,083	0	5	0	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x188b8bfc	36,309	141	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x1bec9c38	33,998	0	0	-	-	-	Allocated memory or stack space
0x30dceeb4	32,258	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x01e08934	31,039	0	1	8	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x0f244028	26,393	0	1	0	-	-	Allocated memory or stack space
0x1be98208	23,249	10,774	0	-	-	-	Allocated memory or stack space
0x01e08bfc	20,390	24	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x1978fc44	19,257	0	2	0	-	-	c:\program files\adobe\reader 9.0\reader\agm.dll
0x01e08a20	10,385	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\bib.dll
0x188b8a20	7,960	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\acord32.dll
0x19a4aeac	6,911	0	0	-	-	-	c:\program files\adobe\reader 9.0\reader\cooltype.dll

Done

My Computer 100%

Figure 3-15 SAPHIRE 8 v8.06.01 Thread Validator General Analysis Critical Sections and Waits Report

3.6 Bug Reporting and Trends

This section will include a list of bugs reported by build and date, note any trends and provide recommendations.

4 Conclusions

We'll draw some conclusions from the latest metrics run and comparisons and provide some recommendations for future actions.