

Static Program Analyzers

Duane Strong

duanes@strongenging.com

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Introduction

It is well known that finding and fixing bugs early in the development process costs orders of magnitude less than when they are found late in system test. Because of this many techniques are used to detect problems in source code before it is deployed. Three methods are generally used: code reviews, unit test, and static analysis. Code reviews are desktop checks of source code done by a small group of reviewers. Unit tests are software test simulation environments targeted to small units of code. Static analysis is an analysis of source code done via an automatic software tool, the classic case being lint. This paper explores using static analysis.

Available Tools

A number of analysis tools are available. Tools differ in what the focus of the analysis is targeted to. They generally fall into three categories: generating metrics, flagging potential errors, and testing conformance to existing coding specifications. The tools that generate metrics are geared at estimating the complexity of source code via a large number of metrics such as lines of code, comment to code ratios, cyclomatic complexity, class fan-out, etc. Tools that attempt to flag potential errors include the compiler itself, however the tools discussed here go beyond checking for valid syntax and attempt to test code fragments that while syntactically legal, appear to break a number of pre-defined rules concerning poor programming habits or rules documented in textbooks such as Scott Meyers Effective C++ and More Effective C++. Tools that check conformance to coding specifications use user-defined rules on such items as variable naming conventions, indenting style, etc.

Scott Meyers has examined a number of tools for checking C++ in his article

http://www.aristeia.com/ddjpaper1_frames.html .

Embedded systems magazine has also published an article covering many popular tools
<http://www.embedded.com/showArticle.jhtml?articleID=23905134>.

Some of these tools and others are summarized in table 1:

Name	Company	Focus	Open Source	
inTellec	www.klocwork.com	metrics		
understand	www.scitools.com	metrics		
PC-lint	www.gimpel.com	errors		
splint	www.splint.org	errors	X	
rsm	www.msquaredtechnologies.com	metrics		
QA C	www.programmingresearch.com	All		
CCCC	sourceforge.net/projects/cccc	metrics	X	
CodeWizard	www.parasoft.com	errors		
CodeCheck	www.abxsoft.com	All		
McCabe QA	www.mccabe.com	metrics		

Table 1

CodeWizard

Due to time and licensing constraints only one analyzer was tested (Note: although I have used CCCC in the past) that being CodeWizard from Parasoft. CodeWizard attaches itself into the Microsoft Visual Studio IDE via a toolbar. Using CodeWizard inside Visual Studio is straightforward and well integrated. Using CodeWizard outside of Visual Studio as a command line tool makes it quite a bit less useful in terms of reviewing the list of potential errors. CodeWizard can be configured to check a large number of pre-existing rules, including those from Effective C++ and More Effective C++. It also contains a user rule editor although I found this to be a very complex exercise and would suggest buying a tool with the desired rules pre-configured. Each rule can be selected active or not. CodeWizard was run on the example uart driver.

As has been my experience in the past with similar tools, the tool generates a copious amount of information that the programmer has to examine to see if it really indicates a problem. The usefulness of the tool therefore is more about how easily the output data can be examined and evaluated. CodeWizard comes with the Insra tool that makes it very easy to examine the output and see the context where the rule was broken. This tool works inside Visual Studio. Without using Insra, the programmer is left to wade through the raw output of Appendix A.

While I found the tool useful and the output generally informative, it did generate a lot of “noise” vs. information. I don’t think many programmers would run the tool more than once on a given project due to this noise/information ratio. There is no doubt that CodeWizard is a useful tool, but I don’t think it would be used that much in a production environment. Its use in conjunction with human code reviews as a review aid would be the most probable use.

Appendix A – CodeWizard Output

[FastQueue.hpp:18] **ecpp-11**

Severe Violation: Effective C++ item 11
Define a copy constructor and operator= for classes with dynamically allocated memory

Class FastQueue missing assignment operator and copy constructor.

```
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18>  
c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18  
<ENDSTACKTRACE>
```

[FastQueue.hpp:18] **user-216**

Violation: User Defined item 216 in class FastQueue
Declare an assignment operator for classes which have data members that are pointers.

Declare an assignment operator in class FastQueue

```
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18>  
c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18  
<ENDSTACKTRACE>
```

[FastQueue.hpp:18] **ecpp-11**

Possible Violation: Effective C++ item 11
Define a copy constructor and operator= for classes with dynamically allocated memory

Class FastQueue missing assignment operator and copy constructor.

```
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18>  
c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18  
<ENDSTACKTRACE>
```

[DrvUart.hpp:23] **ecpp-11**

Severe Violation: Effective C++ item 11
Define a copy constructor and operator= for classes with dynamically allocated memory

Class DrvUart missing assignment operator and copy constructor.

```
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:23>  
c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:23  
<ENDSTACKTRACE>
```

[Driver.hpp:5] **ecpp-14**

Severe Violation: Effective C++ item 14 in class Driver
Make destructors virtual in base classes

Class Driver is a base class but does not have a virtual destructor

```
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\drivers\Driver.hpp:5>  
c:\projects\viasys\uartdriver\drivers\Driver.hpp:5  
<ENDSTACKTRACE>
```

[DrvUart.hpp:84] **mecpp-2**

Violation: More Effective C++ item 2 in class DrvUart
Prefer C++-style casts

Prefer C++-style casts

```
<BEGINSTACKTRACE>
```

```
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:84>
c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:84
<ENDSTACKTRACE>
[DrvUart.hpp:84] **mecpp-2**
```

Violation: More Effective C++ item 2 in class DrvUart
Prefer C++-style casts

```
Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:84>
c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:84
<ENDSTACKTRACE>
[errorsEnd.h:18] **user-740**
```

Possible Violation: User Defined item 740
When using enum, the values of each member should be explicitly declared.

```
The following parameter is not declared: ERR_LAST_ERROR
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\errors\errorsEnd.h:18>
\projects\viasys\uartdriver\errors\errorsEnd.h:18
<ENDSTACKTRACE>
[FastQueue.hpp:18] **user-216**
```

Violation: User Defined item 216 in class FastQueue
Declare an assignment operator for classes which have data members that are pointers.

```
Declare an assignment operator in class FastQueue
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18>
c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18
<ENDSTACKTRACE>
[DrvUart.hpp:23] **user-216**
```

Violation: User Defined item 216 in class DrvUart
Declare an assignment operator for classes which have data members that are pointers.

```
Declare an assignment operator in class DrvUart
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:23>
c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:23
<ENDSTACKTRACE>
[Driver.hpp:2] **user-218**
```

Violation: User Defined item 218 in class DrvUart
Make destructors virtual for all base classes.

```
Destructor for base class is not virtual
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\Driver.hpp:2>
c:\projects\viasys\uartdriver\drivers\Driver.hpp:2
<ENDSTACKTRACE>
[DrvUart.cpp:63] **user-738**
```

Violation: User Defined item 738 in class DrvUart
Use explicit logical tests in conditional expressions.

```
Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.cpp:63>
\projects\viasys\uartdriver\drivers\DrvUart.cpp:63
<ENDSTACKTRACE>
[DrvUart.cpp:63] **user-708**
```

Possible Violation: User Defined item 708 in class DrvrUart
Do not use operator ++ or -- in the conditional expression of if, while, or switch.

Operator ++ or -- is used in the conditional expression of if, while, or switch
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:63>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:63
<ENDSTACKTRACE>
[DrvrUart.cpp:86] **user-738**

Violation: User Defined item 738 in class DrvrUart
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:86>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:86
<ENDSTACKTRACE>
[DrvrUart.cpp:98] **user-738**

Violation: User Defined item 738 in class DrvrUart
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:98>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:98
<ENDSTACKTRACE>
[DrvrUart.cpp:86] **user-739**

Possible Violation: User Defined item 739 in class DrvrUart
Use positive logic rather than negative logic whenever practical.

Use positive logic rather than negative logic whenever possible.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:86>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:86
<ENDSTACKTRACE>
[DrvrUart.cpp:94] **user-708**

Possible Violation: User Defined item 708 in class DrvrUart
Do not use operator ++ or -- in the conditional expression of if, while, or switch.

Operator ++ or -- is used in the conditional expression of if, while, or switch
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:94>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:94
<ENDSTACKTRACE>
[DrvrUart.cpp:147] **user-310**

Possible Severe Violation: User Defined item 310 in class DrvrUart
Eliminate unused parameters.

Parameter named >ucByte< is not used.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:147>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:147
<ENDSTACKTRACE>
[DrvrUart.cpp:152] **user-310**

Possible Severe Violation: User Defined item 310 in class DrvrUart
Eliminate unused parameters.

Parameter named >ucByte< is not used.
<BEGINSTACKTRACE>

```
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:152>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:152
<ENDSTACKTRACE>
[DrvrUart.cpp:132] **user-443**
```

Violation: User Defined item 443
Only one statement shall be allowed per line

```
Too many statements in line
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:132>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:132
<ENDSTACKTRACE>
[DrvrUart.cpp:134] **user-443**
```

Violation: User Defined item 443
Only one statement shall be allowed per line

```
Too many statements in line
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:134>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:134
<ENDSTACKTRACE>
[DrvrUart.cpp:136] **user-443**
```

Violation: User Defined item 443
Only one statement shall be allowed per line

```
Too many statements in line
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:136>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:136
<ENDSTACKTRACE>
[DrvrUart.cpp:138] **user-443**
```

Violation: User Defined item 443
Only one statement shall be allowed per line

```
Too many statements in line
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:138>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:138
<ENDSTACKTRACE>
[DrvrUart.cpp:140] **user-443**
```

Violation: User Defined item 443
Only one statement shall be allowed per line

```
Too many statements in line
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:140>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:140
<ENDSTACKTRACE>
[DrvrUart.cpp:142] **user-443**
```

Violation: User Defined item 443
Only one statement shall be allowed per line

```
Too many statements in line
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvrUart.cpp:142>
\projects\viasys\uartdriver\drivers\DrvrUart.cpp:142
<ENDSTACKTRACE>
[DrvrUart.cpp:63] **user-402**
```

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.cpp:63>
\projects\viasys\uartdriver\drivers\DrvUart.cpp:63
<ENDSTACKTRACE>
[DrvUart.cpp:98] **user-402**

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.cpp:98>
\projects\viasys\uartdriver\drivers\DrvUart.cpp:98
<ENDSTACKTRACE>
[FastQueue.hpp:18] **ecpp-11**

Possible Violation: Effective C++ item 11
Define a copy constructor and operator= for classes with dynamically allocated memory

Class FastQueue missing assignment operator and copy constructor.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18>
c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18
<ENDSTACKTRACE>
[DrvUart.hpp:23] **ecpp-11**

Possible Violation: Effective C++ item 11
Define a copy constructor and operator= for classes with dynamically allocated memory

Class DrvUart missing assignment operator and copy constructor.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:23>
\projects\viasys\uartdriver\drivers\DrvUart.hpp:23
<ENDSTACKTRACE>
[Driver.hpp:5] **ecpp-14**

Severe Violation: Effective C++ item 14 in class Driver
Make destructors virtual in base classes

Class Driver is a base class but does not have a virtual destructor
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\Driver.hpp:5>
c:\projects\viasys\uartdriver\drivers\Driver.hpp:5
<ENDSTACKTRACE>
[DrvUart.hpp:84] **mecpp-2**

Violation: More Effective C++ item 2 in class DrvUart
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:84>
\projects\viasys\uartdriver\drivers\DrvUart.hpp:84
<ENDSTACKTRACE>
[DrvUart.hpp:84] **mecpp-2**

Violation: More Effective C++ item 2 in class DrvUart
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:84>
\projects\viasys\uartdriver\drivers\DrvUart.hpp:84

```
<ENDSTACKTRACE>
[MCF5272.h:13] **ecpp-20**
```

Violation: Effective C++ item 20 in class InterruptRegs
Avoid data members in the public interface

Public data members for class InterruptRegs:

```
unIcr1
unIcr2
unIcr3
unIcr4
unIsr
unPitr
unPiwr
unPivr
```

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\MCF5272.h:13>
c:\projects\viasys\uartdriver\coldfire\MCF5272.h:13
<ENDSTACKTRACE>
[MCF5272.h:83] **ecpp-20**
```

Violation: Effective C++ item 20 in class UartRegs
Avoid data members in the public interface

Public data members for class UartRegs:

```
ucUmr
skip
ucUsrUcsr
skip1
ucUcr
skip2
ucUrbUtb
skip3
ucUipcrUacr
skip4
ucUisrUimr
skip5
ucUdu
skip6
ucUdl
skip7
ucUabu
skip8
ucUabl
skip9
ucUtf
skip10
ucUrf
skip11
ucUfpd
skip12
ucUip
skip13
ucUop1
skip14
ucUop0
skip15
```

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\MCF5272.h:83>
c:\projects\viasys\uartdriver\coldfire\MCF5272.h:83
<ENDSTACKTRACE>
[UartColdfire.hpp:16] **ecpp-11**
```

Possible Violation: Effective C++ item 11
Define a copy constructor and operator= for classes with dynamically allocated
memory

Class UartColdfire missing assignment operator and copy constructor.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.hpp:16>
c:\projects\viasys\uartdriver\coldfire\UartColdfire.hpp:16
<ENDSTACKTRACE>
[UartColdfire.cpp:50] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:50>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:50
<ENDSTACKTRACE>
[UartColdfire.cpp:76] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:76>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:76
<ENDSTACKTRACE>
[UartColdfire.cpp:85] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:85>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:85
<ENDSTACKTRACE>
[UartColdfire.cpp:122] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:122>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:122
<ENDSTACKTRACE>
[UartColdfire.cpp:194] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:194>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:194
<ENDSTACKTRACE>
[UartColdfire.cpp:206] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:206>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:206
<ENDSTACKTRACE>
[UartColdfire.cpp:213] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:213>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:213
<ENDSTACKTRACE>
[UartColdfire.cpp:221] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:221>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:221
<ENDSTACKTRACE>
[UartColdfire.cpp:232] **mecpp-2**

Violation: More Effective C++ item 2 in class UartColdfire
Prefer C++-style casts

Prefer C++-style casts
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:232>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:232
<ENDSTACKTRACE>
[errorsEnd.h:18] **user-740**

Possible Violation: User Defined item 740
When using enum, the values of each member should be explicitly declared.

The following parameter is not declared: ERR_LAST_ERROR
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\errors\errorsEnd.h:18>
\projects\viasys\uartdriver\errors\errorsEnd.h:18
<ENDSTACKTRACE>
[FastQueue.hpp:18] **user-216**

Violation: User Defined item 216 in class FastQueue
Declare an assignment operator for classes which have data members that are pointers.

Declare an assignment operator in class FastQueue
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18>
c:\projects\viasys\uartdriver\drivers\FastQueue.hpp:18
<ENDSTACKTRACE>
[DrvUart.hpp:23] **user-216**

Violation: User Defined item 216 in class DrvrUart
Declare an assignment operator for classes which have data members that are pointers.

Declare an assignment operator in class DrvrUart
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\DrvUart.hpp:23>
\projects\viasys\uartdriver\drivers\DrvUart.hpp:23
<ENDSTACKTRACE>
[Driver.hpp:2] **user-218**

Violation: User Defined item 218 in class DrvrUart
Make destructors virtual for all base classes.

Destructor for base class is not virtual
<BEGINSTACKTRACE>

```
<c:\projects\viasys\uartdriver\drivers\Driver.hpp:2>
c:\projects\viasys\uartdriver\drivers\Driver.hpp:2
<ENDSTACKTRACE>
[UartColdfire.hpp:16] **user-216**
```

Violation: User Defined item 216 in class UartColdfire
Declare an assignment operator for classes which have data members that are pointers.

```
Declare an assignment operator in class UartColdfire
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.hpp:16>
c:\projects\viasys\uartdriver\coldfire\UartColdfire.hpp:16
<ENDSTACKTRACE>
[Driver.hpp:2] **user-218**
```

Violation: User Defined item 218 in class UartColdfire
Make destructors virtual for all base classes.

```
Destructor for base class is not virtual
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\drivers\Driver.hpp:2>
c:\projects\viasys\uartdriver\drivers\Driver.hpp:2
<ENDSTACKTRACE>
[ColdfireConfig.h:31] **user-740**
```

Possible Violation: User Defined item 740 in class UartColdfire
When using enum, the values of each member should be explicitly declared.

```
The following parameter is not declared: UART1_CLOCK_SRC
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\ColdfireConfig.h:31>
c:\projects\viasys\uartdriver\coldfire\ColdfireConfig.h:31
<ENDSTACKTRACE>
[ColdfireConfig.h:34] **user-740**
```

Possible Violation: User Defined item 740 in class UartColdfire
When using enum, the values of each member should be explicitly declared.

```
The following parameter is not declared: UART2_CLOCK_SRC
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\ColdfireConfig.h:34>
c:\projects\viasys\uartdriver\coldfire\ColdfireConfig.h:34
<ENDSTACKTRACE>
[UartColdfire.cpp:108] **user-738**
```

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

```
Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:108>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:108
<ENDSTACKTRACE>
[UartColdfire.cpp:108] **user-739**
```

Possible Violation: User Defined item 739 in class UartColdfire
Use positive logic rather than negative logic whenever practical.

```
Use positive logic rather than negative logic whenever possible.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:108>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:108
<ENDSTACKTRACE>
[UartColdfire.cpp:156] **user-738**
```

Violation: User Defined item 738 in class UartColdfire

Use explicit logical tests in conditional expressions.

Use explicit logical tests.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:156>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:156
<ENDSTACKTRACE>
[UartColdfire.cpp:158] **user-738**
```

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:158>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:158
<ENDSTACKTRACE>
[UartColdfire.cpp:181] **user-738**
```

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:181>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:181
<ENDSTACKTRACE>
[ColdfireConfig.h:28] **user-740**
```

Possible Violation: User Defined item 740 in class UartColdfire
When using enum, the values of each member should be explicitly declared.

The following parameter is not declared: BUS_CLOCK

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\ColdfireConfig.h:28>
c:\projects\viasys\uartdriver\coldfire\ColdfireConfig.h:28
<ENDSTACKTRACE>
[UartColdfire.cpp:237] **user-737**
```

Violation: User Defined item 737 in class UartColdfire
Pass const pointer to function if the value of which the pointer points at is not to be changed.

Pass argument named fn with const specifier

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:237>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:237
<ENDSTACKTRACE>
[UartColdfire.cpp:237] **user-310**
```

Possible Severe Violation: User Defined item 310 in class UartColdfire
Eliminate unused parameters.

Parameter named >vecnum< is not used.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:237>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:237
<ENDSTACKTRACE>
[UartColdfire.cpp:237] **user-310**
```

Possible Severe Violation: User Defined item 310 in class UartColdfire
Eliminate unused parameters.

Parameter named >fn< is not used.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:237>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:237
```

```
<ENDSTACKTRACE>
[UartColdfire.cpp:250] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:250>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:250
<ENDSTACKTRACE>
[UartColdfire.cpp:252] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:252>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:252
<ENDSTACKTRACE>
[UartColdfire.cpp:256] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:256>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:256
<ENDSTACKTRACE>
[UartColdfire.cpp:260] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:260>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:260
<ENDSTACKTRACE>
[UartColdfire.cpp:264] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:264>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:264
<ENDSTACKTRACE>
[UartColdfire.cpp:276] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:276>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:276
<ENDSTACKTRACE>
[UartColdfire.cpp:284] **user-738**

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.
```

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:284>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:284
<ENDSTACKTRACE>
[UartColdfire.cpp:293] **user-738**
```

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:293>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:293
<ENDSTACKTRACE>
[UartColdfire.cpp:295] **user-738**
```

Violation: User Defined item 738 in class UartColdfire
Use explicit logical tests in conditional expressions.

Use explicit logical tests.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:295>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:295
<ENDSTACKTRACE>
[UartColdfire.cpp:247] **user-739**
```

Possible Violation: User Defined item 739 in class UartColdfire
Use positive logic rather than negative logic whenever practical.

Use positive logic rather than negative logic whenever possible.

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:247>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:247
<ENDSTACKTRACE>
[UartColdfire.cpp:250] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire
Do not use the bitwise operator in conditionals expressions.

Bitwise operator used in conditional expressions

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:250>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:250
<ENDSTACKTRACE>
[UartColdfire.cpp:252] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire
Do not use the bitwise operator in conditionals expressions.

Bitwise operator used in conditional expressions

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:252>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:252
<ENDSTACKTRACE>
[UartColdfire.cpp:256] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire
Do not use the bitwise operator in conditionals expressions.

Bitwise operator used in conditional expressions

```
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:256>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:256
<ENDSTACKTRACE>
[UartColdfire.cpp:260] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire

Do not use the bitwise operator in conditionals expressions.

```
Bitwise operator used in conditional expressions
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:260>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:260
<ENDSTACKTRACE>
[UartColdfire.cpp:264] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire
Do not use the bitwise operator in conditionals expressions.

```
Bitwise operator used in conditional expressions
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:264>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:264
<ENDSTACKTRACE>
[UartColdfire.cpp:276] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire
Do not use the bitwise operator in conditionals expressions.

```
Bitwise operator used in conditional expressions
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:276>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:276
<ENDSTACKTRACE>
[UartColdfire.cpp:293] **user-742**
```

Possible Violation: User Defined item 742 in class UartColdfire
Do not use the bitwise operator in conditionals expressions.

```
Bitwise operator used in conditional expressions
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:293>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:293
<ENDSTACKTRACE>
[UartColdfire.cpp:156] **user-402**
```

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

```
Logical tests should be explicit in condition expression
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:156>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:156
<ENDSTACKTRACE>
[UartColdfire.cpp:158] **user-402**
```

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

```
Logical tests should be explicit in condition expression
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:158>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:158
<ENDSTACKTRACE>
[UartColdfire.cpp:181] **user-402**
```

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

```
Logical tests should be explicit in condition expression
<BEGINSTACKTRACE>
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:181>
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:181
<ENDSTACKTRACE>
```

[UartColdfire.cpp:250] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:250>

\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:250

<ENDSTACKTRACE>

[UartColdfire.cpp:252] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:252>

\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:252

<ENDSTACKTRACE>

[UartColdfire.cpp:256] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:256>

\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:256

<ENDSTACKTRACE>

[UartColdfire.cpp:260] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:260>

\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:260

<ENDSTACKTRACE>

[UartColdfire.cpp:264] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:264>

\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:264

<ENDSTACKTRACE>

[UartColdfire.cpp:276] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:276>

\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:276

<ENDSTACKTRACE>

[UartColdfire.cpp:284] **user-402**

Violation: User Defined item 402

An explicit logical comparison should be used in conditional expression

Logical tests should be explicit in condition expression

<BEGINSTACKTRACE>

```
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:284>  
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:284  
<ENDSTACKTRACE>  
[UartColdfire.cpp:293] **user-402**
```

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

```
Logical tests should be explicit in condition expression  
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:293>  
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:293  
<ENDSTACKTRACE>  
[UartColdfire.cpp:295] **user-402**
```

Violation: User Defined item 402
An explicit logical comparison should be used in conditional expression

```
Logical tests should be explicit in condition expression  
<BEGINSTACKTRACE>  
<c:\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:295>  
\projects\viasys\uartdriver\coldfire\UartColdfire.cpp:295  
<ENDSTACKTRACE>
```