

# Use of XSLT to transform the output of multiple Static Code Analysis tools into a consistent analysis spreadsheet format

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# Agenda

<b>Introduction, Description of the Problem</b>	<b>03</b>
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For various reasons, it is useful:

- To export the results of a Static Code Analysis (SCA) tool into an external spreadsheet (e.g. Excel) for offline analysis.
- To run more than one SCA tool against a code baseline.

We present a practical way to solve a problem that IV&V Analysts who use SCA tools may encounter.

- The method details are specific to two common SCA tools, Klocwork and CodeSonar.



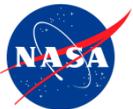
## Why export results to Excel?

- Independent of a Static Analysis Tool's Vendor-specific GUI
  - Not using a license while investigating
  - Data can be analyzed offline
- Flexible sorting and filtering options
- Easily allows Metrics, Status to be collected
- Data can be arranged and displayed as desired
- Users may want different "disposition data" than that provided by the tool



## Why run more than one SCA tool?

- Each SCA tool has a unique set of checkers. Running multiple tools allows analysts to cover a larger set of checks than is possible with a single tool.
- SCA tools each have their strengths and weaknesses. Running multiple tools can provide a greater level of assurance that the code is free of defects.



- "Flattening"
  - XML data can be arbitrarily deep. Excel uses a "flattening" algorithm by default which may result in duplicate rows



# Problems when Importing Tool output in Raw XML or CSV to Excel

- Different Tools call equivalent data by different names

Klocwork Insight 10 Problem	Value		CodeSonar 4.0 Warning	Value
problemID		match	id	
		duplicate	file	
		duplicate	directory	
filePath		match but capitalization differs	file_path	
method		match but namespace differs	procedure	
checkerCode		near match	categories	
message		near match	class	
citingStatus	Analyze Ignore Not a Problem Fix Fix in Next Release Fix in Later Release Defer Filter	near-equivalent use	finding	Don't Care Don't Know False Positive None True Positive Unconfirmed peer review waiting on peer review
state	New Existing Fixed	Similar, but Klocwork self-assigns	state	Assigned Fixed Invalid Later New None
owner		match	owner	
			priority	None P0: High P1: Medium P2: Low Suppressed
severitylevel		duplicate		
severity	1 to 10	similar but distinct	rank	1 to 100
line	integer	match	line_number	integer
url		match but CS is relative path	url	
taxonomy name		near match	language	
			modified	
			detected	
			first_detected	
			fingerprint	



# Problems when Importing Tool output in Raw XML or CSV to Excel

- Different Tools may present data in a slightly different format

Klocwork Insight 10 Problem	Value		CodeSonar 4.0 Warning	Value
problemID		match	id	
		duplicate	file	
		duplicate	directory	
filePath		match but capitalization differs	file_path	
method		match but namespace differs	procedure	
checkerCode		near match	categories	
message		near match	class	
	Analyze Ignore Not a Problem Fix Fix in Next Release Fix in Later Release Defer Filter			Don't Care Don't Know False Positive None True Positive Unconfirmed peer review waiting on peer review
citingStatus		near-equivalent use	finding	
				Assigned Fixed Invalid Later New None
state	New Existing Fixed	Similar, but Klocwork self-assigns	state	
owner		match	owner	
				None P0: High P1: Medium P2: Low Suppressed
severitylevel		duplicate		
severity	1 to 10	similar but distinct	rank	1 to 100
line	integer	match	line_number	integer
url		match but CS is relative path	url	
taxonomy name		near match	language	
			modified	
			detected	
			first_detected	
			fingerprint	



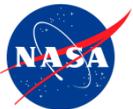
## The Solution?

- Export the output of the chosen SCA tools in XML format
- Use an XSLT stylesheet to transform the output to a consistent (different) XML file
- Import the resulting XML file(s) into Excel



# What are XML and XSLT?

- XML – eXtensible Markup Language
  - A standardized way of encoding data into a format that is both human and machine readable.
- XSLT – eXtensible Stylesheet Language Transformations
  - A language for transforming XML documents into other formats (other XML documents, HTML, etc.)



## Advantages of using XSLT to transform tool output

- XML/XSLT processing is "built in" to Excel
- Designed specifically to transform XML data
- Easily configurable to arrange and transform data
- Simple to combine the output of multiple tools into a single worksheet
- Formatting is not project-specific but rather tool-specific
  - e.g. Any Klocwork or Codesonar output can be used with a single template



## Steps for using the XSLT transform

1. Export the SCA tool output in XML format
2. Add a reference to the Excel Transform stylesheet into the XML output
3. Open the XML output file in Excel.



# Export the SCA tool output in XML format

## For Klocwork:

- Use the Report Generator Instructions provided by SWAT:  
<https://ecmls.faircon.net/livelinek/livelinek/open/5834299>
- Log in to pluto server
- Run KlocworkReportGenerator.py script
  - ==> `cd /tools/python`
  - ==> `python KlocworkReportGenerator.py --url https://pluto:8068 --project cFE --xml ~/cFE_output.xml --getline`
- Copy the output file from pluto to your desktop PC.



## Export the SCA tool output in XML format

For CodeSonar:

- Open the web GUI and select the project.
- Right-click the bar with the column headings and select "More Columns >" and select the desired columns to add to the display. In addition to the default columns, select "File Path" and "Categories".



# Export the SCA tool output in XML format

Home | Tips | Manual | About | Settings | Sign out b\_markle

**CODESONAR** Search  for   | [Advanced Search](#)

Home > cFE > cFE analysis 3  CSV | XML | Visible Warnings: active

**cFE : cFE analysis 3** < previous next >

**Finished**

[Analysis Details](#) | [Charts and Tables](#) | [Reports](#) | [Metrics](#) | [Compare](#) | [Visualization](#)

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Goto  [Show More](#) [Show Fewer](#)

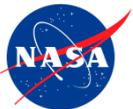
ID	Class	Rank	File	File Path	Line Number	Procedure	Priority	State	Finding	Owner
784276.1314000	Uninitialized Variable	37	<a href="#">Sort Ascending</a> <a href="#">Sort Descending</a>	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	688	CFE_ES_WaitForStartupSync	None	None	None	
784250.1314029	Uninitialized Variable	37	<a href="#">Move Left</a> <a href="#">Move Right</a>	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	1899	CFE_ES_LockSharedData	None	None	None	
784251.1314028	Uninitialized Variable	37	<a href="#">Reset Table</a>	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	1933	CFE_ES_UnlockSharedData	None	None	None	
784286.1313990	No Space For Null Terminator	41	<a href="#">Chart by File</a> <a href="#">Hide Column</a>	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	965	CFE_ES_GetTaskInfo	None	None	None	
784283.1313993	No Space For Null Terminator	41	<a href="#">More Columns &gt;</a> <a href="#">Show Notes</a>	projects/cFE-6.3.2-OSS-release/cfe/src/es/cfe_es_api.c	965	CFE_ES_GetTaskInfo	None	None	None	
784277.1313999	No Space For Null Terminator	41	cfe_es_api.c	projects/cFE-6.3.2-OSS-release/cfe/src/es/cfe_es_api.c	965	CFE_ES_GetTaskInfo	None	None	None	
784287.1313989	No Space For Null Terminator	42	cfe_es_api.c	projects/cFE-6.3.2-OSS-release/cfe/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
784288.1313988	No Space For Null Terminator	42	cfe_es_api.c	projects/cFE-6.3.2-OSS-release/cfe/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
784319.1313958	No Space For Null Terminator	42	cfe_es_api.c	projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
784282.1313994	No Space For Null Terminator	42	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
784336.1313940	No Space For Null Terminator	42	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
784340.1313936	No Space For Null Terminator	42	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	



## Export the SCA tool output in XML format

For CodeSonar:

- In the upper right area of the page, select the "XML" link to export the results to XML.



# Export the SCA tool output in XML format

Home | Tips | Manual | About | Settings | Sign out b\_markle

 **CODESONAR** Search  for   | [Advanced Search](#)

Home > cFE > cFE analysis 3  CSV | **XML** | Visible Warnings: active

**cFE : cFE analysis 3** < previous next >

**Finished**

[Analysis Details](#) | [Charts and Tables](#) | [Reports](#) | [Metrics](#) | [Compare](#) | [Visualization](#)

**Warnings** | Files | Procedures |<< < 1 - 100 of 251 > >> | Goto  [Show More](#) [Show Fewer](#)

ID	Class	Rank	Categories	File	File Path	Line Number	Procedure	Priority	State	Finding	Owner
784276.1314000	Uninitialized Variable	37	LANG.MEM.UVAR;CWE:457;CWE:908	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	688	CFE_ES_WaitForStartupSync	None	None	None	
784250.1314029	Uninitialized Variable	37	LANG.MEM.UVAR;CWE:457;CWE:908	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	1899	CFE_ES_LockSharedData	None	None	None	
784251.1314028	Uninitialized Variable	37	LANG.MEM.UVAR;CWE:457;CWE:908	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	1933	CFE_ES_UnlockSharedData	None	None	None	
784286.1313990	No Space For Null Terminator	41	MISC.MEM.NTERM;CWE:170	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	965	CFE_ES_GetTaskInfo	None	None	None	
784283.1313993	No Space For Null Terminator	41	MISC.MEM.NTERM;CWE:170	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	965	CFE_ES_GetTaskInfo	None	None	None	
784277.1313999	No Space For Null Terminator	41	MISC.MEM.NTERM;CWE:170	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	965	CFE_ES_GetTaskInfo	None	None	None	
784287.1313989	No Space For Null Terminator	42	MISC.MEM.NTERM;CWE:170	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
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784319.1313958	No Space For Null Terminator	42	MISC.MEM.NTERM;CWE:170	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	
784282.1313994	No Space For Null Terminator	42	MISC.MEM.NTERM;CWE:170	cfe_es_api.c	/home/swat/projects/cFE-6.3.2-OSS-release/cfe/fsw/cfe-core/src/es/cfe_es_api.c	872	CFE_ES_GetAppName	None	None	None	



## Add a reference to the Excel Transform stylesheet into the XML output

- Open each XML output file in a text editor.
- Add the following tag as the second line of the output file to associate the output with the XSLT stylesheet:

```
<?xml-stylesheet href="excel_transform.xsl" type="text/xsl"?>
```

- Place the excel\_transform.xsl file in the same directory as the tool output XML file.



# Open the XML output file in Excel

## From within Excel:

- File => Open
- Select the analysis tool output XML file.
- Click "Open"

## You will see a number of prompts. Answer them as follows:

- "The file you are opening contains stylesheet(s). What would you like to do:
  - o Select "Open the file with the following stylesheet applied (select one):"
    - Select "excel\_transform.xsl" and click "OK"
- "The file you are trying to open, '<filename>', is in a different format than specified by the file extension. Verify that the file is not corrupted and is from a trusted source before opening the file. Do you want to open the file now?"
  - o Select "Yes"
- "Please select how you would like to open this file:"
  - o Select "As an XML table" and click "OK"



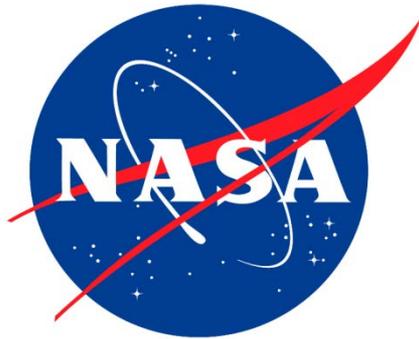
- Make sure to generate the tool output to include Line numbers, according to SWAT instructions:
  - <https://ecmls.faircon.net/livelinek/livelinek/open/5834299>
- Something within the xmlns (XML Namespace) attribute of the errorList tag prevents the data from being imported into Excel correctly. A workaround is to delete the attributes from the tag at the top of the file. (this tag will be the third line in the file after the xml-styleesheet> tag has been added as the second line.



# References

- The source code used in examples is from NASA's Core Flight Executive (cFE) framework for embedded applications, and is in the public domain:
  - <http://code.nasa.gov/project/core-flight-executive-cfe/>
- Static Analysis tools used:
  - Klocwork Insight 10.0: <http://www.klocwork.com/>
  - CodeSonar 4.0: <http://www.grammatech.com/codesonar/>
- XML and XSLT are open standards produced by the World Wide Web Consortium (W3C):
  - <http://www.w3.org/XML/>
  - <http://www.w3.org/TR/xslt>
- Spreadsheet software used:
  - Microsoft Excel 2010: <http://office.microsoft.com/en-us/excel/>





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