Nreturn User Manual

Version: 1.0.0

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Introduction

Nreturn is a software utility that analyzes C source and header files and reports functions that have multiple exit paths. These are functions that create maintenance risk for the project where minor modifications need disproportionate verification effort. Nreturn could also be used to list multiple while loops in functions. Such functions with multiple while loops in them when reviewed could expose long functions being invoked inside nested while loops causing potential risk to Scheduling latencies and slip in Execution deadlines.

Another typical use of Nreturn is to list all functions in the project that invoke inline delays or semaphore locks. When such a list in the project is monitored for every release of the project it would help control growth of critical code in the project.

Reports are generated in Text and Excel Workbook formats.

System Requirements

Nreturn is a Windows console application / Command line program and requires 32-bit version of Windows 2000 or Windows XP. Tests have not been performed on Windows Vista.

To generate Excel Workbook reports from Nreturn, Microsoft Excel should be already installed in the PC. Tests have only been performed with Microsoft Excel 2000 and Microsoft Excel 2003.

OpenOffice is not supported.

Invocation

Nreturn is delivered as an executable, which does not require Installation. Extract the contents of the delivered Zip file into a Windows folder and Nreturn can be executed from a Command Prompt in that folder.

Nreturn analyzes the C Source and all included Header and Configuration files. For Nreturn to analyze all your project files, the project has to be presented as one single folder containing all relevant C Source and included Header and Configuration files in it.

Normally in Distributed Software Development Organization, Software is stored under Configuration Management systems like Perforce or Clearcase and the files making the project reside in different folders and subfolders. It is also possible that the source files stored in Configuration Management include files that are not linked to the final executable (Hex file of the ECU) .It is the responsibility of the User to collect all the files that are relevant to the Project being analyzed and present to Nreturn in one single folder.

Nreturn can be invoked from a Command Prompt as follows

```
Nreturn.exe    ProjectSourcesFolder
Nreturn.exe    avoidxlreport=1               ProjectSourcesFolder
Nreturn.exe    output=ReportName             threshold=5      ProjectSourcesFolder
Nreturn.exe    output=ReportName             genppoutput=0  ProjectSourcesFolder
Nreturn.exe    output=ReportName             search=while     ProjectSourcesFolder
Nreturn.exe    search=myinlinedelayfunc      ProjectSourcesFolder
```

where the last argument ProjectSourcesFolder is the folder containing all the Source and Header files of the project being analyzed.

Options

output

The analysis results of Nreturn are generated in a simple Text format and in Microsoft Excel format. The filename of the reports by default is MyMultipleReturns.txt and MyMultipleReturns.xls. To generate the reports under a different name the option **output** can be used.

Option format
output=ReportName
(Nreturn will then generate ReportName.txt and ReportName.xls)

avoidxlreport

For Users who do not wish to generate Excel reports and only intend to use Reports in Text format, the option **avoidxlreport** could be used to suppress Excel report generation.

Option format
avoidxlreport=1
(0 implies generate Excel report and 1 implies suppress Excel report)

search

Nreturn by default searches for return statements in functions. If the User may wish to search for while statements or a particular function being invoked, this option could be used to specify the search Tag.

Option format
search=while
search= myinlinedelayfunc

threshold

This option specifies the minimum number of occurrences of the search Tag in a function for it to be reported by Nreturn.

If this option is not specified, Nreturn would assume a threshold default of 1.

Option format
threshold=N

cpreprocess

Nreturn is delivered with a C language pre-processor. Files for analysis are first preprocessed and then analyzed. If the User already has preprocessed files from the Project make or build process, **cpreprocess** option could be used to suppress Preprocessing again by Nreturn.

It should be noted that when the option **cpreprocess** is used to skip Preprocessing during Nreturn the options **genppoutput** and **compdirective** would have no effect.

Care should be taken that if the files input for analysis in ProjectSourcesFolder have not been preprocessed yet but the User skips Preprocessing by Nreturn, the reports generated by Nreturn could show functions from code that is not actively compiled which anyway does not pose a maintenance risk.

We strongly recommend not turning off Preprocessing by Nreturn.

Option format
cpreprocess =1
(0 implies skip Preprocessing on Source files before analysis
1 implies perform Preprocessing on Source files before analysis)

genppoutput

Nreturn is delivered with a C language pre-processor. Files for analysis are first preprocessed and then analyzed. By default Nreturn stores preprocessed files under a Subfolder in the ProjectSourcesFolder. This will be useful in understanding the reports better. If Users intend not to generate the intermediate Preprocessor output files it could be suppressed with the option **genppoutput**.

Option format
genppoutput=1
(0 implies suppress Preprocessor output and 1 implies generate Preprocessor output)

compdirective

In complicated Software build environments it is possible that Source files are passed make switches, which alter software configuration and behaviour. Such make switches are normally passed through the make files during Compiler invocation and might not be visible in the Source or Header files. It is also possible that Compilers generate special switches, which are available to Source files, and these switches alter software behaviour.

The discussion of the make process and Compiler directives passed during Compiler invocation is beyond the scope of this User Manual.

The format of the compiler directives file to be used during the Preprocessing is documented in the Sections of the User Manual to follow.

Option format
compdirective=CompDir
(Nreturn will then include directives in CompDir.txt during Preprocessing)

Passing Compiler Directives to the Preprocessor during Nreturn Analysis

As mentioned in the Sections above the option **compdirective** could be used to pass make switches and Compiler options to Nreturn when the Preprocessing is not skipped during Analysis. The format of a Directives file is given below. Any line starting with a C++ comment "//" is treated as a comment in the Annotation file.

```
// Add your comments here
-D __ghs__
-D __V850
```

Known Issues

Nreturn when run directly on C source files with cpreprocess option to skip Preprocessing would include code in comments. Comments are not stripped when preprocessing is skipped.

Special Extensions

Normally in Software Development of Safety Critical Applications, Software is organized in Configuration Management Systems like Clearcase or Perforce under multiple VOBs or Depots. Different departments then deliver Software from different VOBs or Depots under Software Platform or Subsystem model of Distributed Software Development.

The tools are available for purchase as Single Computer Single User license. If your company prefers having multi-user licenses or have Excel Workbook reports customized to have different Excel Sheets for different Software Platforms/Subsystems, please contact us at Sales@SkandanTech.com