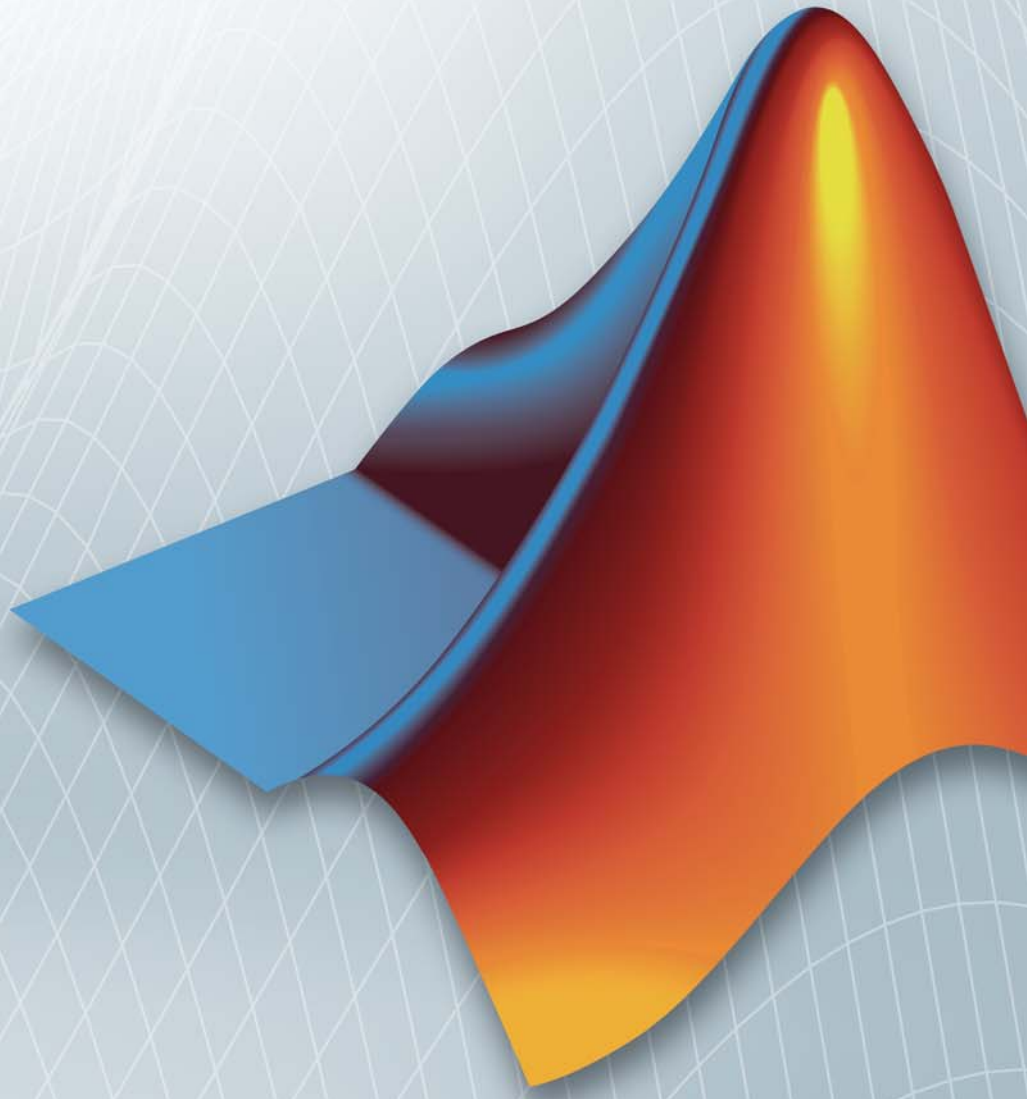
Polyspace® Products for C 8

Getting Started Guide



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The MathWorks, Inc.
3 Apple Hill Drive
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Polyspace® Products for C Getting Started Guide

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2 Setting Up a Polyspace Project

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5 Checking MISRA C Compliance

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1

Introduction to Polyspace Products for Verifying C Code

Product Overview

In this section...

Overview of Polyspace Verification

Polyspace® products verify C, C++, and Ada code by detecting run-time errors before code is compiled and executed. Polyspace verification uses formal methods not only to detect errors, but to prove mathematically that certain classes of run-time errors do not exist.

To verify the source code, you set up verification parameters in a project, run the verification, and review the results. A graphical user interface helps you to efficiently review verification results. Results are color-coded:

- **Green** – Indicates code that never has an error.
- **Red** – Indicates code that always has an error.
- **Gray** – Indicates unreachable code.
- **Orange** – Indicates unproven code (code that might have an error).

The color-coding helps you to quickly identify errors and find the exact location of an error in the source code. After you fix errors, you can easily run the verification again.

The Value of Polyspace Verification

Polyspace verification can help you to:

- "Ensure Software Reliability" on page 1-3
- "Decrease Development Time" on page 1-3
- "Improve the Development Process" on page 1-4

Ensure Software Reliability

Polyspace software ensures the reliability of your C applications by proving code correctness and identifying run-time errors. Using advanced verification techniques, Polyspace software performs an exhaustive verification of your source code.

Because Polyspace software verifies all possible executions of your code, it can identify code that:

- Never has an error
- Always has an error
- Is unreachable
- Might have an error

With this information, you know how much of your code is free of run-time errors, and you can improve the reliability of your code by fixing errors.

You can also improve the quality of your code by using Polyspace verification software to check that your code complies with MISRA C® standards.[1]

Decrease Development Time

Polyspace software reduces development time by automating the verification process and helping you to efficiently review verification results. You can use it at any point in the development process. However, using it during early coding phases allows you to find errors when it is less costly to fix them.

You use Polyspace software to verify C source code before compile time. To verify the source code, you set up verification parameters in a project, run the verification, and review the results. This process takes significantly less time than using manual methods or using tools that require you to modify code or run test cases.

Color-coding of results helps you to quickly identify errors. You will spend less time debugging because you can see the exact location of an error in the source code. After you fix errors, you can easily run the verification again.

1. MISRA and MISRA C are registered trademarks of MISRA Ltd., held on behalf of the MISRA Consortium.

Using Polyspace verification software helps you to use your time effectively. Because you know which parts of your code are error-free, you can focus on the code that has definite errors or might have errors.

Reviewing code that might have errors (orange code) can be time-consuming, but Polyspace software helps you with the review process. You can use filters to focus on certain types of errors or you can allow the software to identify the code that you should review.

Improve the Development Process

Polyspace software makes it easy to share verification parameters and results, allowing the development team to work together to improve product reliability. Once verification parameters have been set up, developers can reuse them for other files in the same application.

Polyspace verification software supports code verification throughout the development process:

- An individual developer can find and fix run-time errors during the initial coding phase.
- Quality assurance engineers can check overall reliability of an application.
- Managers can monitor application reliability by generating reports from the verification results.

Product Components

In this section...

Polyspace Products for C

The Polyspace products for verifying C code are combined with the Polyspace products for verifying C++ code. These products are:

- Polyspace® Client™ for C/C++
- Polyspace® Server™ for C/C++

Polyspace Client for C/C++ software is the management and visualization tool of Polyspace products. You use it to submit jobs for execution by the Polyspace Server, and to review verification results.

Polyspace Server for C/C++ software is the computational engine of Polyspace products. You use it to run jobs posted by Polyspace clients, and to manage multiple servers and queues.

Polyspace Verification Environment

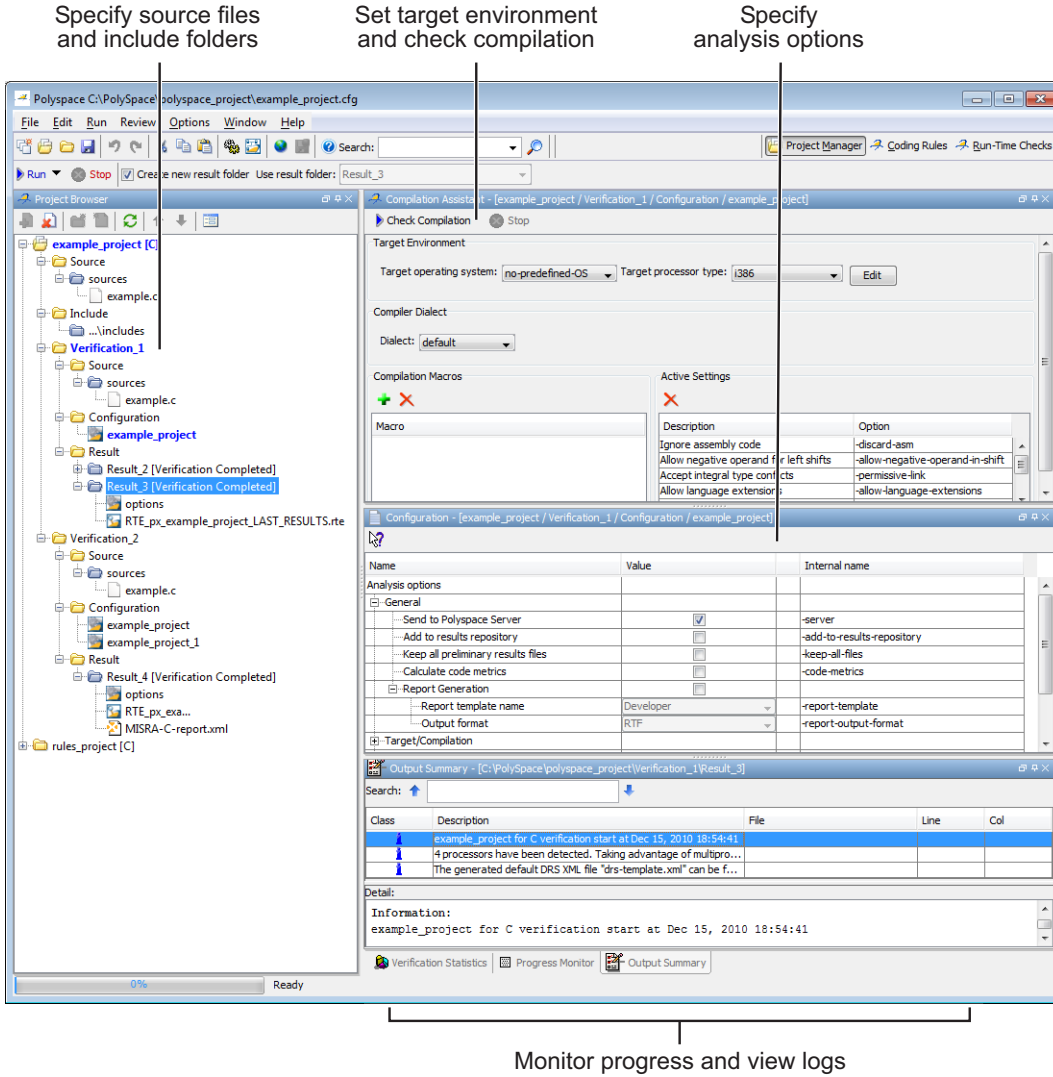
The Polyspace verification environment (PVE) is the graphical user interface of the Polyspace Client for C/C++ software. You use the Polyspace verification environment to create Polyspace projects, launch verifications, and review verification results.

The Polyspace verification environment consists of three perspectives:

- "Project Manager Perspective" on page 1-6
- "Coding Rules Perspective" on page 1-7
- "Run-Time Checks Perspective" on page 1-8

Project Manager Perspective

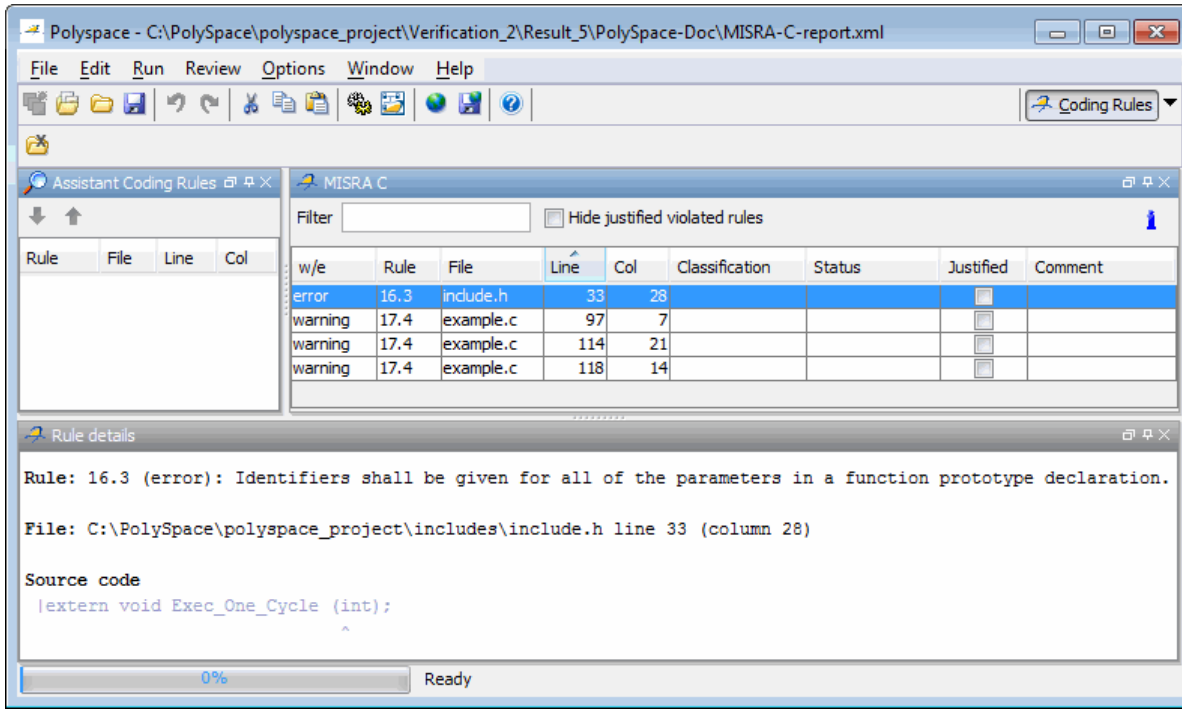
The Project Manager perspective allows you to create projects, set verification parameters, and launch verifications.



You use the Project Manager perspective in the tutorial in Chapter 2, “Setting Up a Polyspace Project”.

Coding Rules Perspective

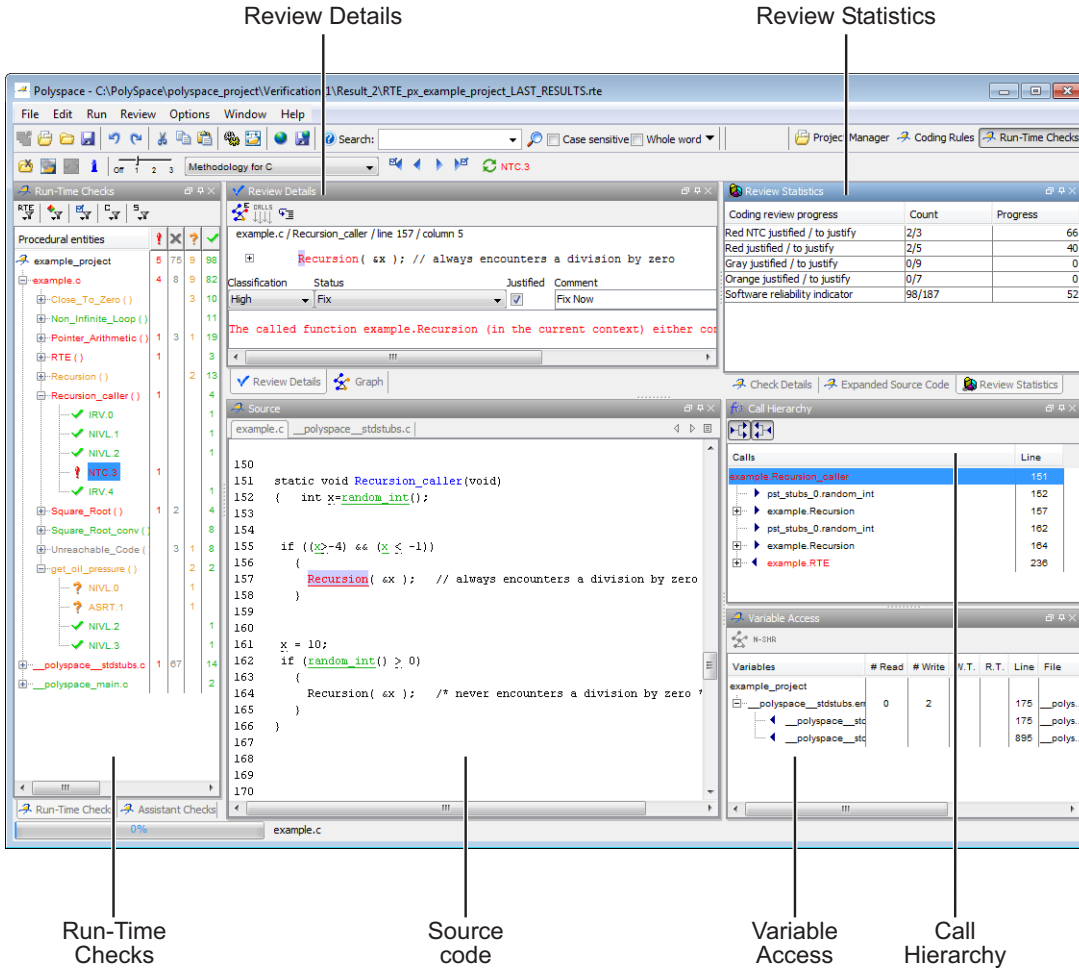
The Coding Rules perspective allows you to review results from the Polyspace coding rules checker, to ensure compliance with established coding standards.



You use the Coding Rules perspective in the tutorial in Chapter 5, “Checking MISRA C Compliance”.

Run-Time Checks Perspective

The Run-Time Checks perspective allows you to review verification results, comment individual checks, and track review progress.



You use the Run-Time Checks perspective in the tutorial in Chapter 4, “Reviewing Verification Results”.

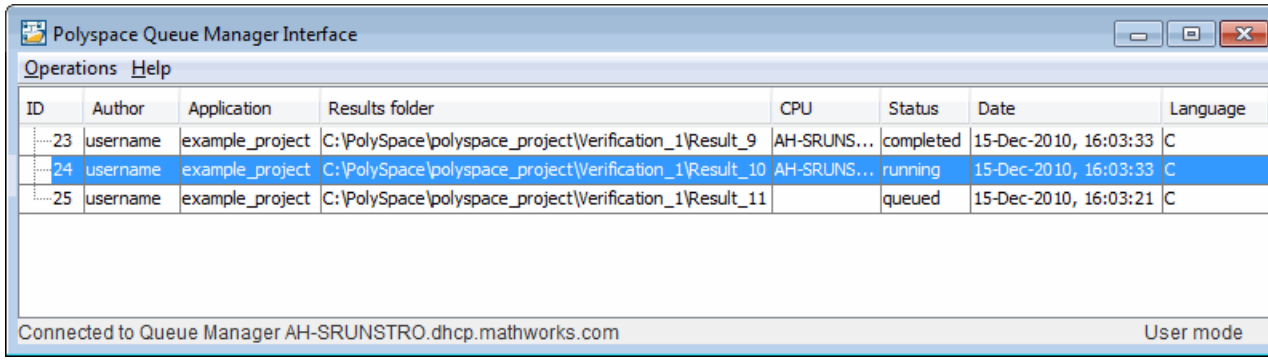
Other Polyspace Components

In addition to the Polyspace verification environment, Polyspace products provide several other components to manage verifications, improve productivity, and track software quality. These components include:

- Polyspace Queue Manager Interface (Spooler)
- Polyspace in One Click
- Polyspace Metrics Web Interface

Polyspace Queue Manager Interface (Polyspace Spooler)

The Polyspace Queue Manager (also called the Polyspace Spooler) is the graphical user interface of the Polyspace Server for C/C++ software. You use the Polyspace Queue Manager Interface to move jobs within the queue, remove jobs, monitor the progress of individual verifications, and download results.



You use the Polyspace Queue Manager in the tutorial “Launching Server Verification from Project Manager” on page 3-10.

Polyspace in One Click

Polyspace in One Click is a convenient way to verify multiple files using the same set of options.

After creating a project with the options that you want, you can use Polyspace in One Click to designate that project as the *active project*, and then send source files to Polyspace software for verification with a single mouse click.

You use Polyspace in One Click in the tutorial "Using Polyspace In One Click to Launch Verification" on page 3-23.

Polyspace Metrics Web Interface

Polyspace Metrics is a web-based tool for software development managers, quality assurance engineers, and software developers. Polyspace Metrics allows you to evaluate software quality metrics, and monitor changes in code metrics, coding rule violations, and run-time checks through the lifecycle of a project.

For information on using Polyspace Metrics, see "Software Quality with Polyspace Metrics"in the *Polyspace Products for C User's Guide*.

Installing Polyspace Products

In this section...

Finding the Installation Instructions

The tutorials in this guide require Polyspace Client for C/C++ and Polyspace Server for C/C++. Instructions for installing Polyspace products are in the *Polyspace Installation Guide*. Before installing Polyspace products, you must obtain the necessary licenses.

Obtaining Licenses for Polyspace Client for C/C++ and Polyspace Server for C/C++

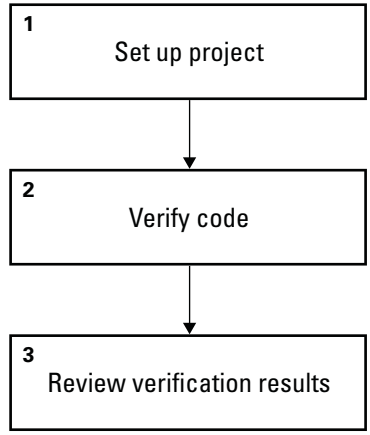
For information about obtaining licenses for Polyspace products, see "Polyspace License Installation" in the *Polyspace Installation Guide*.

Working with Polyspace Software

In this section...

Basic Workflow

The following graphic shows the basic workflow for using Polyspace software to verify C source code.



In this workflow, you:

1. Use the Project Manager perspective to set up a project file.
2. Verify code on a server or client.

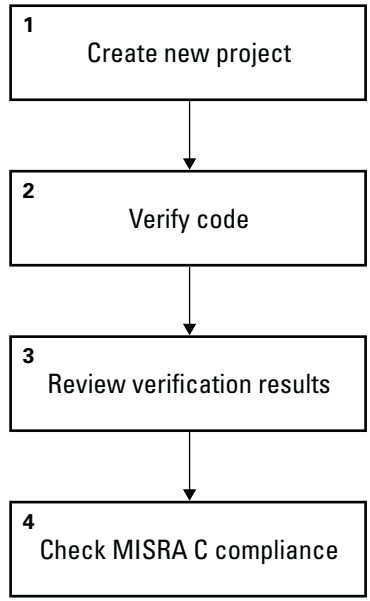
   You can use the Project Manager perspective to start the verification or you can select files from a Microsoft® Windows® folder and send them to Polyspace software for verification. For verifications that run on a server, you use the Polyspace Queue Manager Interface (Polyspace Spooler) to

manage the verification and download the results to a client. You can set an option to check MISRA C compliance in the first stage of the verification.[2]

3 Use the Run-Time Checks perspective to review verification results.

Tutorials in This Guide

The tutorials guide you through the basic workflow, including the different options for running verifications. The following graphic shows the workflow you follow in these tutorials.



In this workflow, you:

1 Create a new project that you use for the workflow.

This step is in the tutorial in Chapter 2, “Setting Up a Polyspace Project”.

2 Verify a single C file.

2. MISRA and MISRA C are registered trademarks of MISRA Ltd., held on behalf of the MISRA Consortium.

This step is in the tutorial in Chapter 3, “Running a Verification”. In this tutorial, you verify the same file using three different methods of running a verification:

- Start a verification that runs on a server using the Project Manager perspective.
- Send files to a server for verification using Polyspace In One Click.
- Start a verification that runs on a client using the Project Manager perspective.

3 Review the verification results.

This step is in the tutorial in Chapter 4, “Reviewing Verification Results”.

4 Modify the project to include MISRA C checking and review the MISRA C violations in the example file.

This step is in the tutorial in Chapter 5, “Checking MISRA C Compliance”.

Additional Information and Support

In this section...

Product Help

To access Polyspace online Help, select **Help > Help** .

To access the online documentation for Polyspace products, go to:

```
/www.mathworks.com/access/helpdesk/help/toolbox/polyspace/polyspace.html
```

MathWorks Online

For additional information and support, go to:

```
www.mathworks.com/products/polyspace
```

Related Products

In this section...

Polyspace Products for Verifying C++ Code

For information about Polyspace products that verify C++ code, go to:

`http://www.mathworks.com/products/polyspaceclientc/`

`http://www.mathworks.com/products/polyspaceserverc/`

Polyspace Products for Verifying Ada Code

For information about Polyspace products that verify Ada code, go to:

`http://www.mathworks.com/products/polyspaceclientada/`

`http://www.mathworks.com/products/polyspaceserverada/`

Polyspace Products for Linking to Models

For information about Polyspace products that link to models, go to:

`http://www.mathworks.com/products/polyspacemodelsl/`

`http://www.mathworks.com/products/polyspaceumlrh/`

2

Setting Up a Polyspace Project

About Setting Up a Project Tutorial

In this section...

Overview

You must have a project before you can run a Polyspace verification of your source code. In this tutorial, you create the project that you use to run verifications in later tutorials.

Example Files

This tutorial uses the source file `example.c` that comes with the installation. You learn more about the files and folders required for this tutorial in "Preparing Project Folders" on page 2-4.

Creating a New Project

In this section...

What Is a Project?

In Polyspace software, a project is a named set of parameters for verification of your software project's source files. A project includes:

- Source files
- Include folders
- One or more configurations, specifying a set of analysis options
- One or more verifications, each of which include:
  - Source (specific versions of source files used in the verification)
  - Configuration (specific set of analysis options used for the verification)
  - Verification results

You can create your own project or use an existing project. You create and modify a project using the Project Manager perspective.

In this tutorial, you create a new project and save it as a configuration file (`.cfg`).

Preparing Project Folders

Before you start verifying a C file with Polyspace software, you must know the locations of the C source file and the include files. You must also know where you want to store the verification results.

For each project, you decide where to store source files and results. For example, you can create a project folder, and then in that folder, create separate folders for the source files, include files, and results.

For this tutorial, prepare a project folder as follows:

1. Create a project folder named `polyspace_project`.
2. Open `polyspace_project`, and create the following folders:
   - `sources`
   - `includes`
3. Copy the file `example.c` from

   `Polyspace_Install``\Examples\Demo_C_Single-File\sources`

   to

   `polyspace_project\sources`

   `Polyspace_Install` is the installation folder.
4. Copy the files `include.h` and `math.h` from

   `Polyspace_Install``\Examples\Demo_C_Single-File\sources`

   to

   `polyspace_project\includes`.

Opening Polyspace Verification Environment

You use the Polyspace verification environment to create projects, start verifications, and review verification results.

To open the Polyspace verification environment:

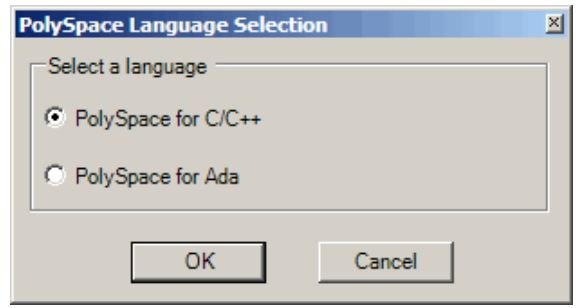
1. Double-click the **Polyspace** icon (Windows systems).

Note On a Linux® or UNIX® system, use the following command:

```
/usr/local/Polyspace/PVE/bin/polyspace
```

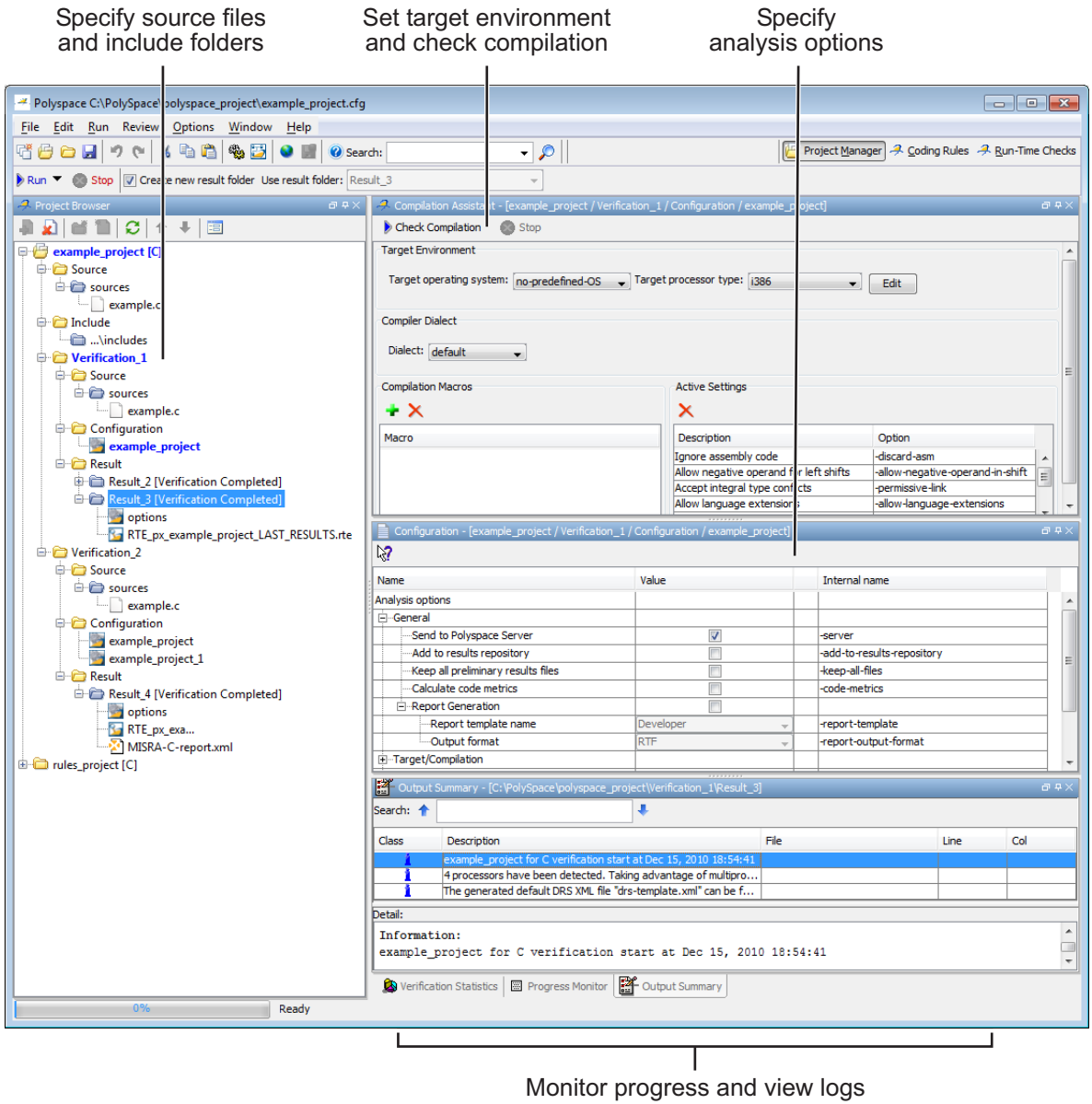
---

2. If you have only Polyspace Client for C/C++ software installed on your computer, skip this step. If you have both Polyspace Client for C/C++ and Polyspace Client for Ada products on your system, the Polyspace Language Selection dialog box opens.



3. Select **Polyspace for C/C++** and click **OK**.

The Polyspace Verification Environment opens.


Specify source files and include folders
Set target environment and check compilation
Specify analysis options
Monitor progress and view logs

By default, the Polyspace Verification Environment displays the Project Manager perspective. The Project Manager perspective has three main panes.

Use this section...	For...
Project Browser (upper-left)	Specifying: • Source files • Include folders • Results folder
Configuration (upper-right)	Specifying analysis options
Output (lower-right)	Monitoring the progress of a verification, and viewing status, log messages, and general verification statistics.

You can resize or hide any of these panes. You learn more about the Project Manager perspective later in this tutorial.

Creating a New Project to Verify the Example C File

You must have a project, saved with file type `cfg`, to run a verification. In this part of the tutorial, you create a new project for verifying `example.c`.

You create a new project by:

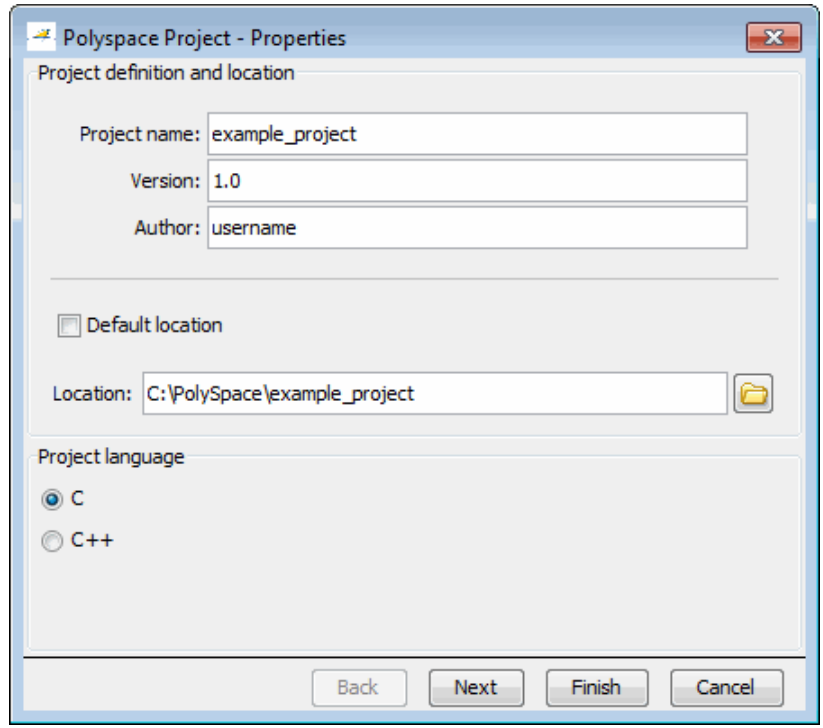
- "Opening a New Project" on page 2-7
- "Specifying Source Files and Include Folders" on page 2-11
- "Specifying Target Environment" on page 2-12
- "Specifying Analysis Options" on page 2-13
- "Saving the Project" on page 2-14

Opening a New Project

To open a new project for verifying `example.c`:

1 Select **File > New Project**.

The Polyspace Project – Properties dialog box opens:



2 In the **Project name** field, enter `example_project`.

3 Clear the **Default location** check box.

Note Clearing the **Default location** check box allows you to specify the location of your project files. In this tutorial, you change the default location to the project folder that you created in "Preparing Project Folders" on page 2-4. Changing the default location makes it easier to specify source files and include folders.

---

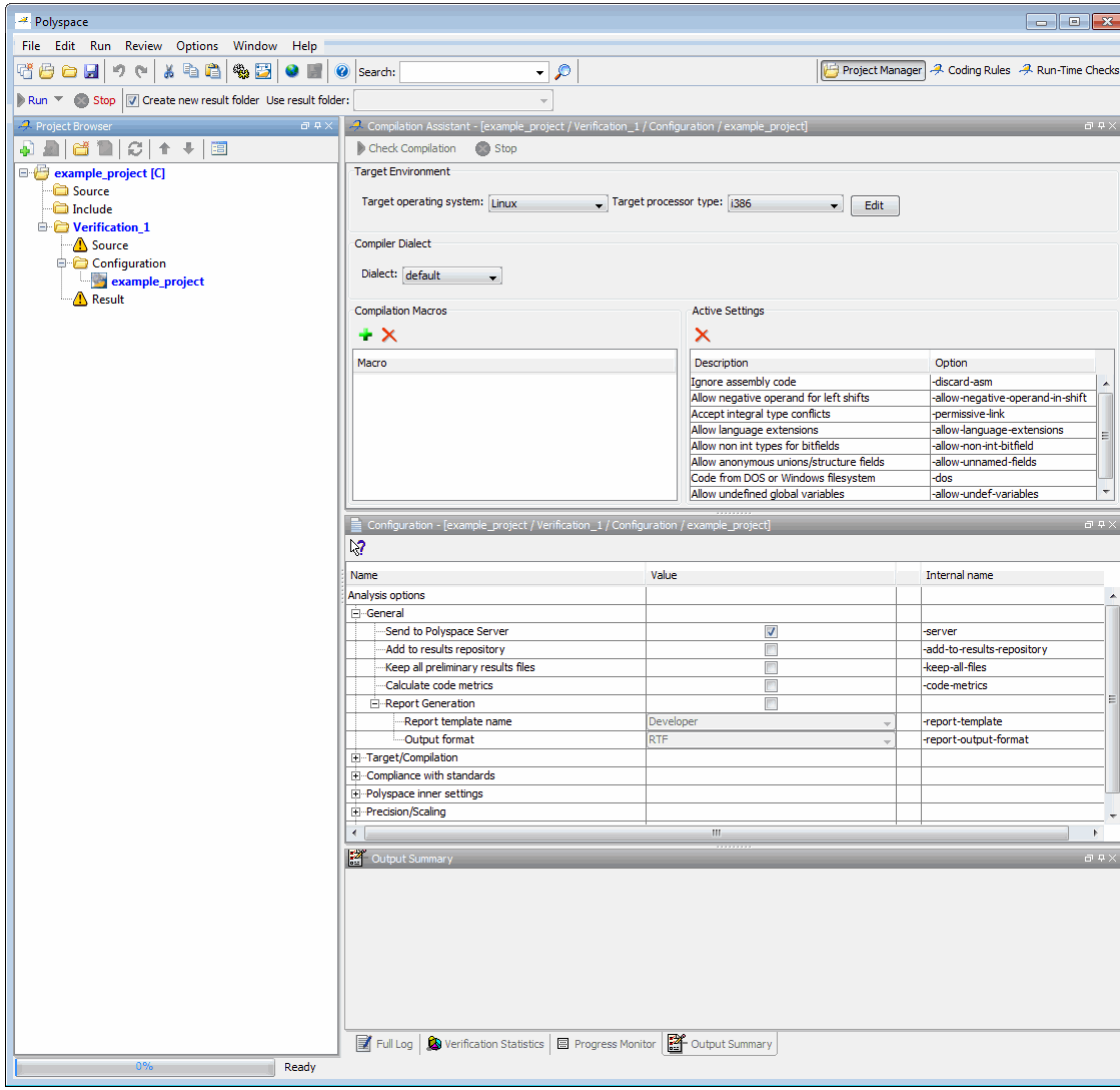
4 In the **Location** field, enter or navigate to the project folder that you created earlier.

   In this example, the project folder is `C:\Polyspace\polyspace_project`.

5 In the Project language section, select **C.**

6 Click **Finish**.

   The `example_project` opens in the Polyspace verification environment.


Polyspace
File Edit Run Review Options Window Help
Search:
Project Manager
Coding Rules
Run-Time Checks
Run
Stop
Create new result folder
Use result folder:
Project Browser
example_project [C]
Source
Include
Verification_1
Source
Configuration
example_project
Result
Compilation Assistant - [example_project / Verification_1 / Configuration / example_project]
Check Compilation
Stop
Target Environment
Target operating system: Linux
Target processor type: i386
Edit
Compiler Dialect
Dialect: default
Compilation Macros
Macro
Active Settings
Description
Option
Ignore assembly code
-discard-asm
Allow negative operand for left shifts
-allow-negative-operand-in-shift
Accept integral type conflicts
-permissive-link
Allow language extensions
-allow-language-extensions
Allow non int types for bitfields
-allow-non-int-bitfield
Allow anonymous unions/structure fields
-allow-unnamed-fields
Code from DOS or Windows filesystem
-dos
Allow undefined global variables
-allow-undef-variables
Configuration - [example_project / Verification_1 / Configuration / example_project]
Name
Value
Internal name
Analysis options
General
Send to Polyspace Server
-server
Add to results repository
-add-to-results-repository
Keep all preliminary results files
-keep-all-files
Calculate code metrics
-code-metrics
Report Generation
Report template name
Developer
-report-template
Output format
RTF
-report-output-format
Target/Compilation
Compliance with standards
Polyspace inner settings
Precision/Scaling
Output Summary
Full Log
Verification Statistics
Progress Monitor
Output Summary
0%
Ready

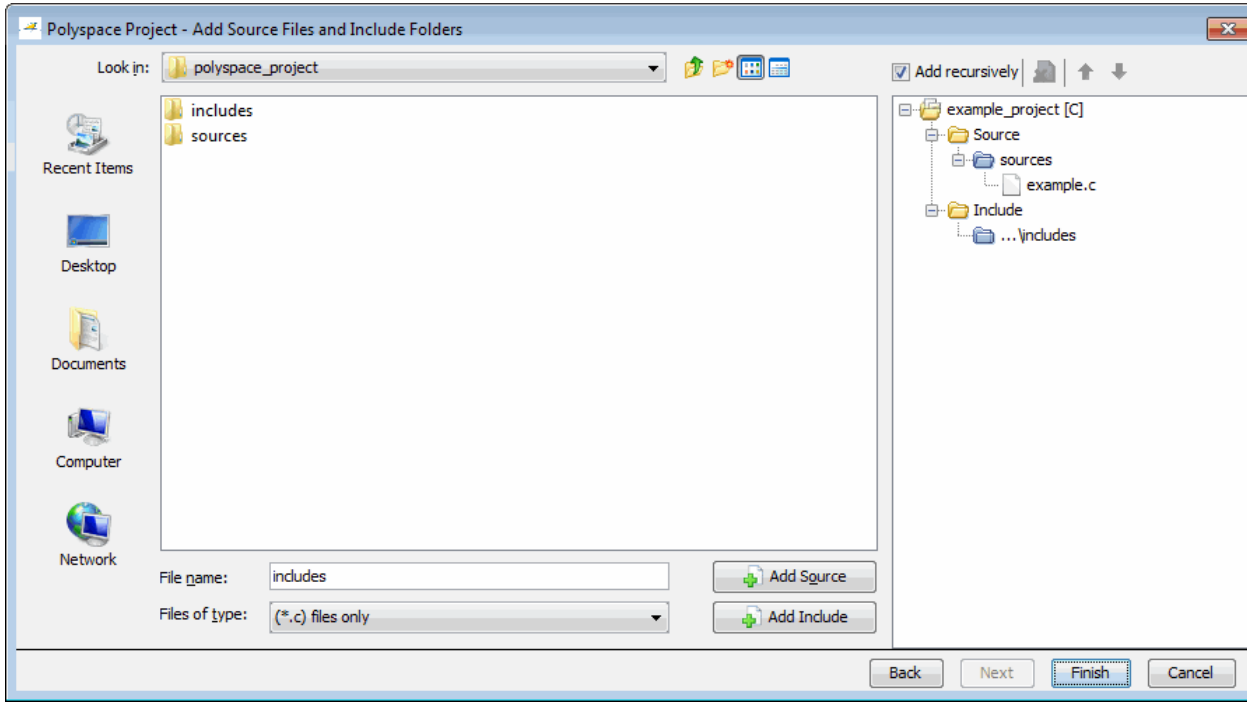
Specifying Source Files and Include Folders

To specify the source files and include folders for the verification of `example.c`:

1. In the Project Browser, select the Source folder.

2. Click the **Add source** icon  in the upper left the Project Browser.

   The Polyspace Project – Add Source Files and Include Folders dialog box opens.



3. The project folder `polyspace_project` should appear in **Look in**. If it does not, navigate to that folder.

4. Select the `sources` folder, then click **Add Source**.

   The `example.c` file appears in the Source tree for `example_project`.

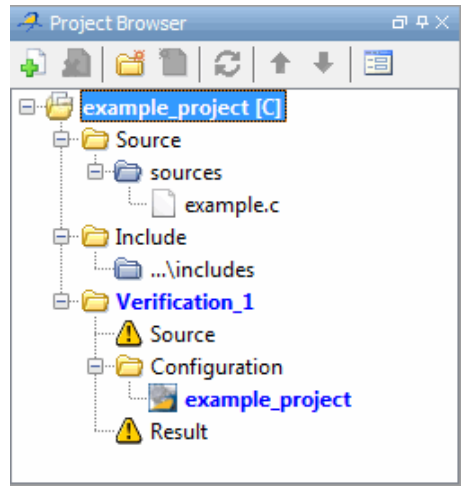
5 Select the `includes` folder, then click **Add Include**.

The `includes` folder appears in the Include tree for `example_project`.

Note In addition to the include folders you specify, Polyspace software automatically adds the standard includes to your project.

6 Click **Finish** to apply the changes and close the dialog box.

The Project Browser now looks like the following graphic.



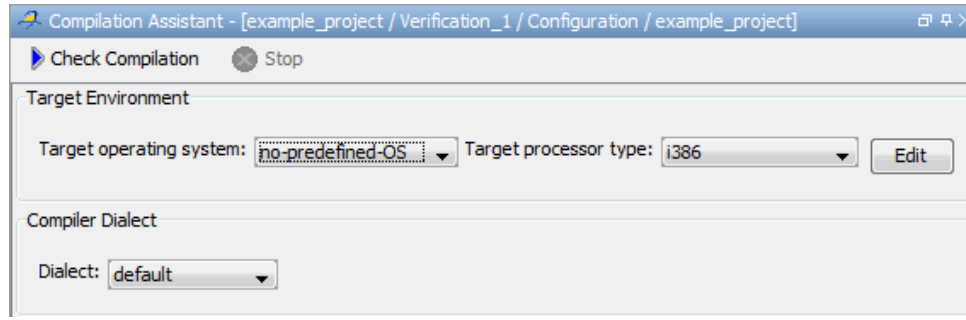
Specifying Target Environment

Many applications are designed to run on specific target CPUs and operating systems. Since some run-time errors are dependent on the target, you must specify the type of CPU and operating system used in the target environment before running a verification.

The Compilation Assistant window in the top-right section of the Project Manager perspective allows you to specify the target operating system and processor type for your application.

To specify the target environment for this tutorial:

1. In the **Target operating system** drop-down menu, select `no_predefined_OS`.



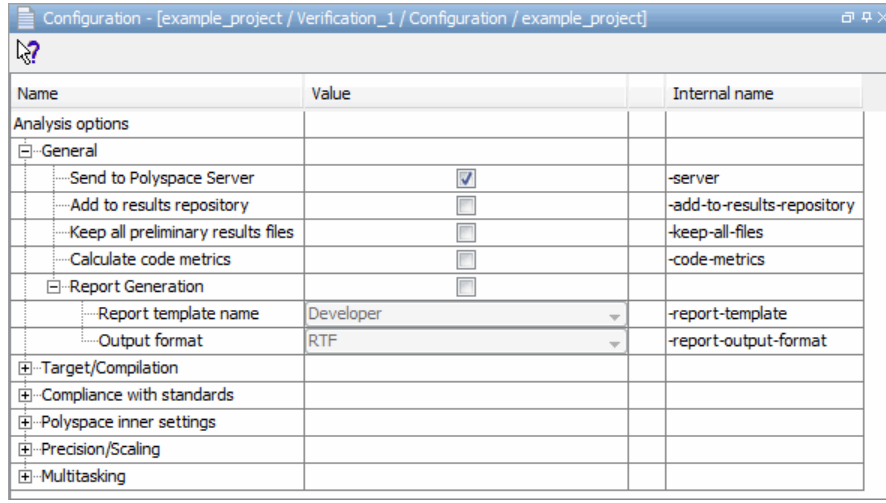
2. In the **Target processor type** drop down menu, select `i386`.

For more information about emulating your target environment, see "Setting Up a Target"in the *Polyspace Products for C User's Guide*.

Specifying Analysis Options

The Configuration window in the middle-right section of the Project Manager perspective allows you to set Analysis options that Polyspace software uses during the verification process.

For this tutorial, you should use the default values for all options.



For more information about analysis options, see “Options Description” in the *Polyspace Products for C Reference*.

Saving the Project

To save the project, select **File > Save**.

Polyspace software saves your project using the Project name and Location you specified when creating the project.

3

Running a Verification

About Running a Verification Tutorial

In this section...

Overview

Once you have created the project `example.cfg`, as described in "Creating a New Project" on page 2-3, you can run the verification.

You can run a verification on a server or a client.

Use...	For...
Server	• Best performance • Large files (more than 800 lines of code, including comments) • Multitasking
Client	• An alternative to the server when the server is busy • Small files with no multitasking **Note** Verification on a client takes more time. You might not be able to use your client computer when a verification is running on it.

You can start a verification using either the Project Manager or Polyspace In One Click. With either method, the verification can run on a server or a client.

Use...	For...
Project Manager	A basic way to start a verification. You specify the source files in the project file. With the project open, you click a button to start the verification.
Polyspace In One Click	A convenient way to start the verification of several files which use the same verification options. Once you specify the project file containing the verification options, you specify the source files by selecting them from a Microsoft Windows folder. You start the verification by sending the selected files to Polyspace software.

In this tutorial, you learn how to run a verification on a server and on a client, and how to start a verification using the Project Manager and Polyspace In One Click. You verify the file `example.c` three times using a different method each time. You use:

- Project Manager to start a verification that runs on a server.
- Polyspace In One Click to start a verification that runs on a server.
- Project Manager to start a verification that runs on a client.

Each verification stores the same results in your project. You review these results in the tutorial Chapter 4, “Reviewing Verification Results”.

Before You Start

Before you start this tutorial, you must complete Chapter 2, “Setting Up a Polyspace Project”. You use the folders and project file, `example.cfg`, from that tutorial.

Preparing for Verification

In this section...

Opening the Project

To run a verification, you must have an open project file. For this tutorial, you use the project file `example.cfg` that you created in Chapter 2, "Setting Up a Polyspace Project". If `example_project.cfg` is not already open, open it.

To open `example_project.cfg`:

1. If the Polyspace software is not already open, open it.
2. Select **File > Open Project**.

   The Open a Polyspace project file dialog box opens.
3. In the **Look in** drop-down list box, navigate to `polyspace_project`.
4. Select `example_project.cfg`.
5. Click **Open** to open the file and close the dialog box.

Specifying Source Files to Verify

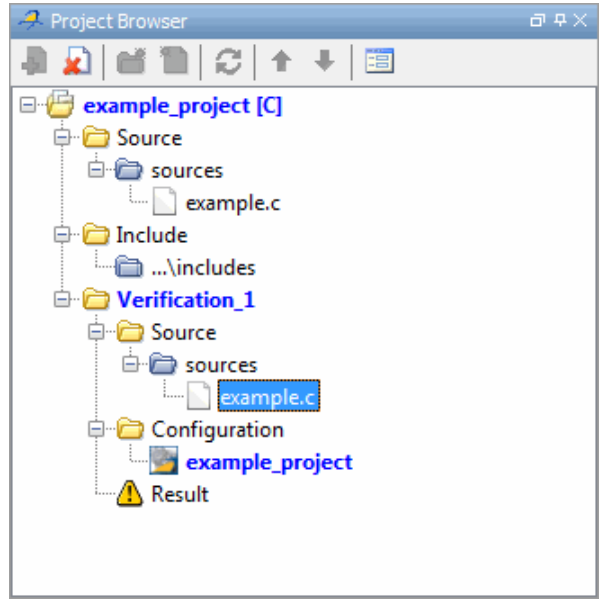
Each Polyspace project can contain multiple verifications. Each of these verifications can analyze a specific set of source files using a specific set of analysis options.

Therefore, before you launch a verification, you must specify which files in your project that you want to verify. In the `example_project` in this tutorial, there is only one file to verify.

To copy source files to a verification:

1. In the Project Browser Source tree, right click `example.c`.
2. Select **Copy Source File to > Verification_(1).**

   The `example.c` file appears in the Source tree of `Verification_(1)`.

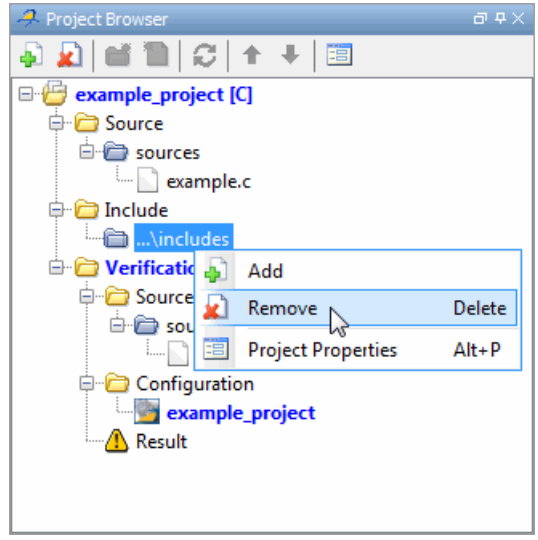


Checking for Compilation Problems

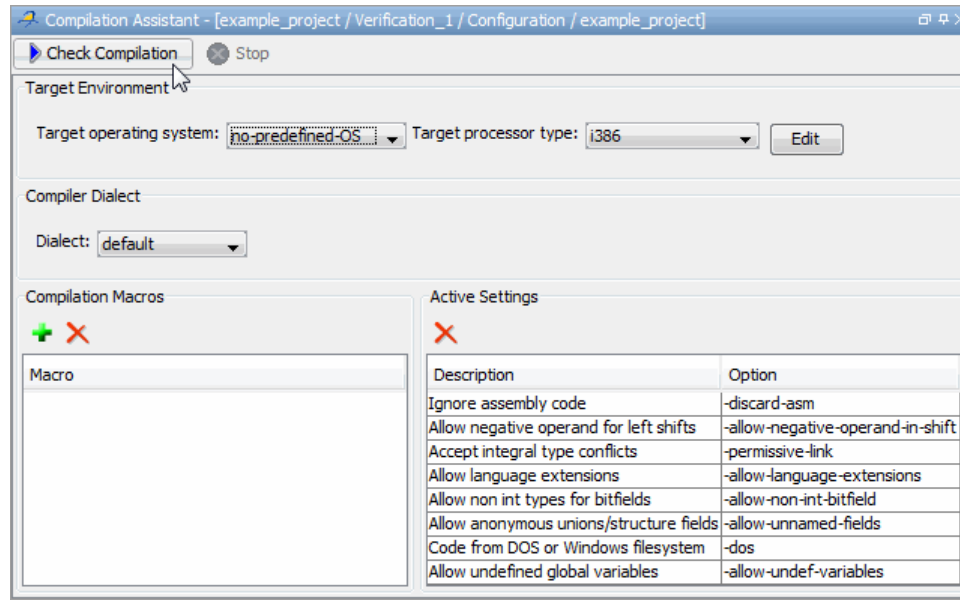
The Compilation Assistant allows you to check your project for compilation problems before launching a verification. When the Compilation Assistant detects an error, it reports the problem and suggests possible solutions.

To check your project for compilation problems:

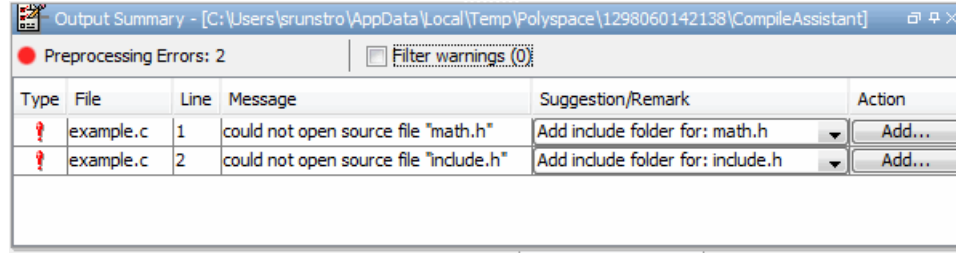
1 In the Project Browser Source tree, right click the Include folder (`..\includes`), then select **Remove**. This will cause a compilation error.



2 In the Compilation Assistant window, click **Check Compilation**.

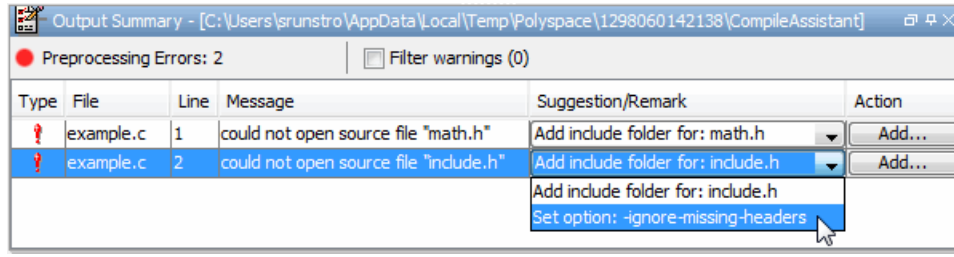


The software compiles your code and checks for errors, and reports the results in the Output Summary.



Because you removed the include folder, the software reports a compilation error for the project, along with suggested solutions for the problem.

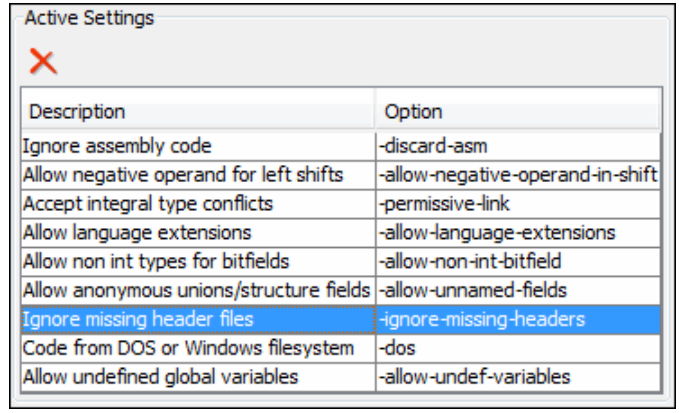
3 Select the Suggestion/Remark column to see a list of possible solutions for the problem.



In this case, you can either add the missing include file, or set an option that will attempt to compile the code without the missing include file.

4 Select `Set option: -ignore-missing-headers`, then click **Apply**.

5 The software automatically sets the option **Ignore missing header files** for your project, and displays the option in the Compilation Assistant Active Settings table.

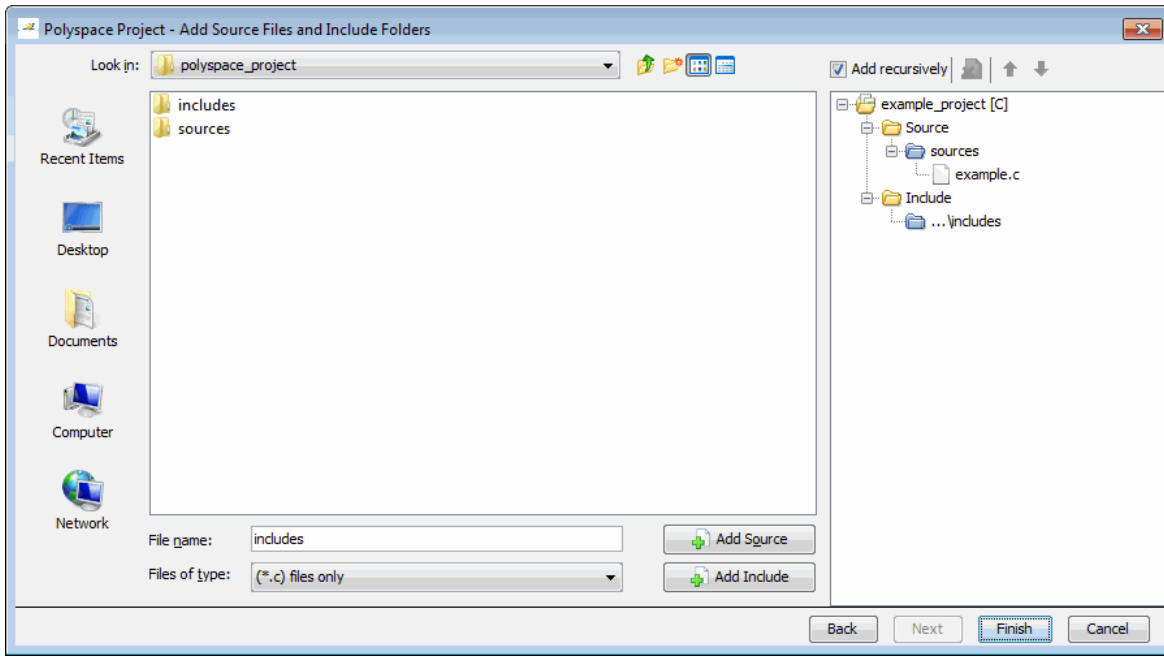


6 Select **Check Compilation** to check your project again.

The same errors appear, since the code cannot be compiled without `include.h`.

7 In the Output Summary window, select `Add include folder for: include.h`, then click **Add**.

The Add Source Files and Include Folders dialog box opens.



8 If necessary, navigate to the `polyspace_project` folder.

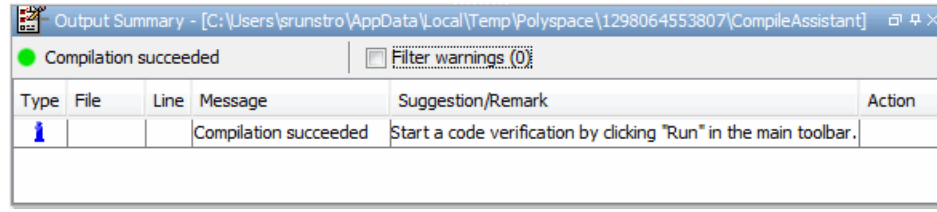
9 Select the `includes` folder, then click **Add Include**.

The `includes` folder appears in the Include tree for `example_project`.

10 Click **Finish**.

11 Select **Check Compilation** in the Compilation Assistant to check your project again.

The message `Compilation succeeded` appears in the Output Summary.



Launching Server Verification from Project Manager

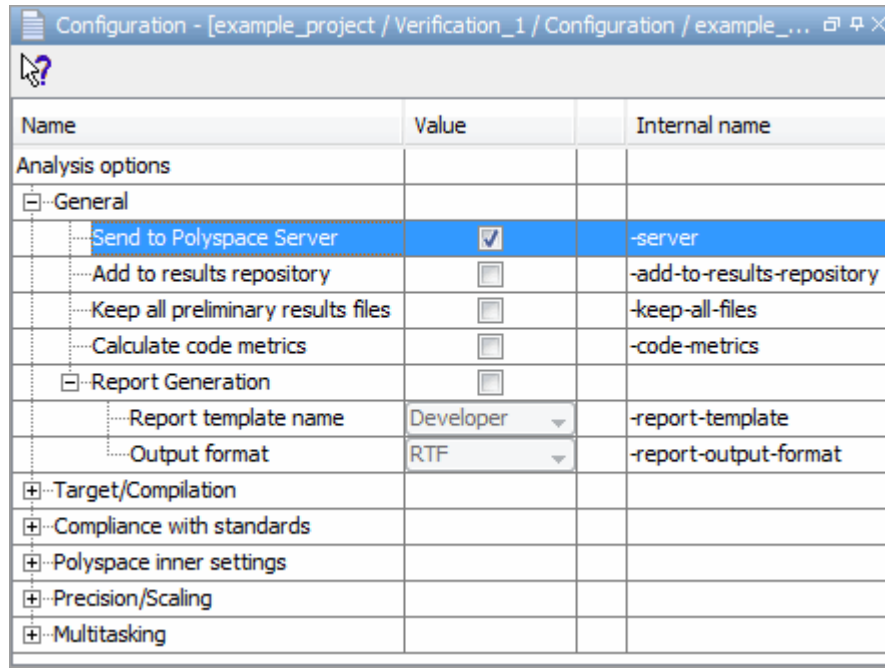
In this section...

Starting the Verification

In this part of the tutorial, you run the verification on a server.

To start a verification that runs on a server:

1. Select the **Send to Polyspace Server** check box in the General Analysis options.



2 Click the **Run** button 

on the Project Manager toolbar.

Note If you see the message `Verification process failed`, click **OK** and go to "Troubleshooting a Failed Verification" on page 3-20.

The verification has three main phases:

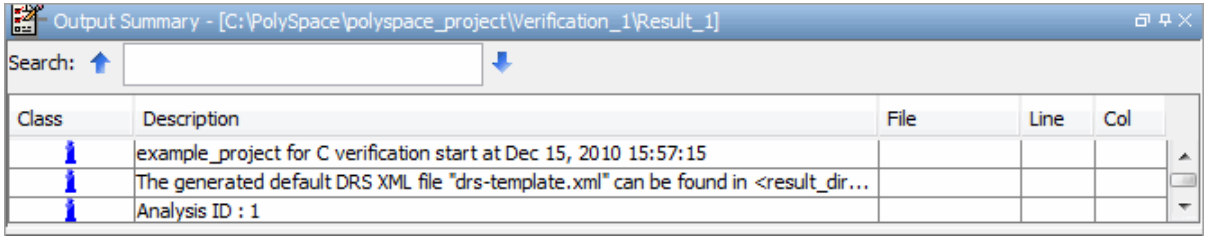
a Checking syntax and semantics (the compile phase). Because Polyspace software is independent of any particular C compiler, it ensures that your code is portable, maintainable, and complies with ANSI® standards.

b Generating a main if the Polyspace software does not find a main and you have selected the **Generate a Main** option. For more information about generating a main, see "Main Generator Behavior for Polyspace Software" in the *Polyspace Products for C Reference*.

c Analyzing the code for run-time errors and generating color-coded results.

The compile phase of the verification runs on the client. When the compile phase is complete:

- You see the message `queued on server` at the bottom of the Project Manager perspective. This message indicates that the part of the verification that takes place on the client is complete. The rest of the verification runs on the server.
- A message in the Output Summary window gives you the identification number (Analysis ID) for the verification. For this verification, the identification number is `1`.



3 For information on any message in the log, click the message.

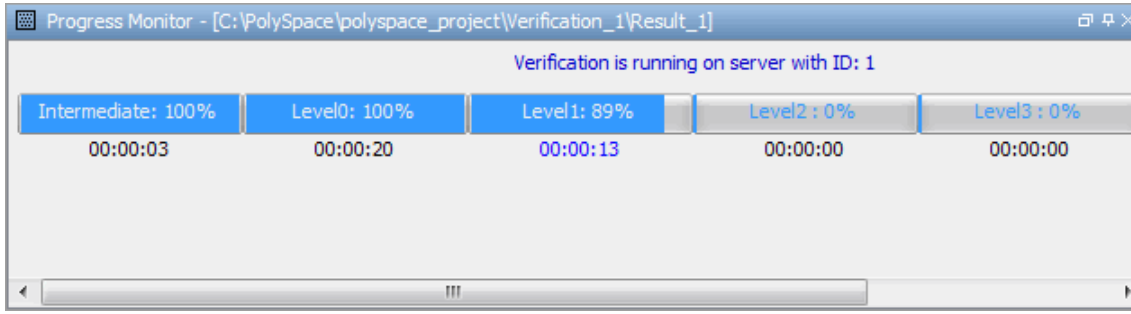
Monitoring Progress of the Verification

There are two ways to monitor the progress of a verification:

- **Using the Project Manager** – allows you to follow the progress of the verifications you submitted to the server, as well as client verifications.
- **Using the Queue Manager (Spooler)** – allows you to follow the progress of any verification job in the server queue.

Monitoring Progress Using Project Manager

You can monitor the progress of your verification by viewing the progress monitor and logs at the bottom of the Project Manager perspective.



The progress monitor highlights the current phase in blue and displays the amount of time and completion percentage for that phase.

The logs report additional information about the progress of the verification. To view a log, click the button for that log. The information appears in the log display area at the bottom of the Project Manager window. Follow the next steps to view the logs:

1. Click the **Output Summary** tab to display compile phase messages and errors. You can search the log by entering search terms in the **Search in the log** box and clicking the left arrows to search backward or the right arrows to search forward.
2. Click the **Verification Statistics** tab to display statistics, such as analysis options, stubbed functions, and the verification checks performed.

3 Click the **Refresh** button  to update the display as the verification progresses.

4 Click the **Full Log** tab to display messages, errors, and statistics for all phases of the verification.

Note You can search the logs. In the **Search in the log** box, enter a search term and click the left arrows to search backward or the right arrows to search forward.

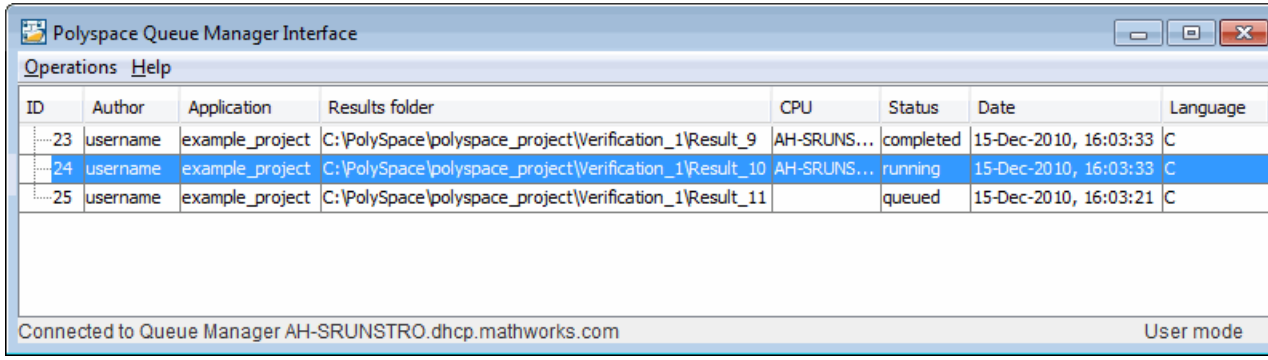
Monitoring Progress Using Queue Manager

You monitor the progress of the verification using the Polyspace Queue Manager (also called the Spooler).

To monitor the verification of `Example_Project`:

1 Double-click the **Polyspace Spooler** icon on the desktop.

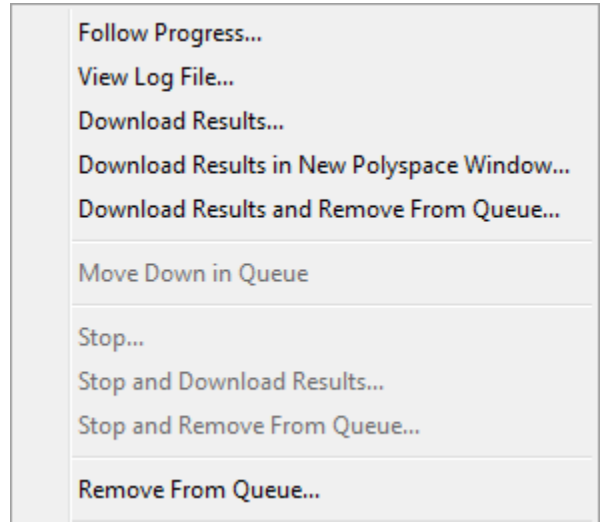
The Polyspace Queue Manager Interface opens.



Tip You can also open the Polyspace Queue Manager Interface by clicking the Polyspace Queue Manager icon on the Run-Time Checks perspective toolbar.

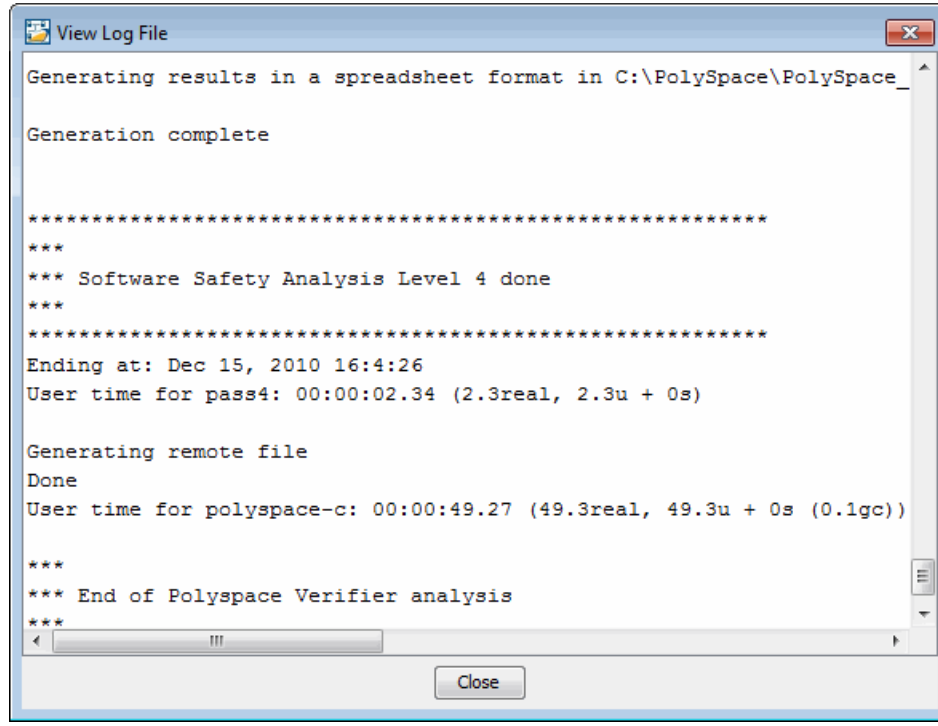
2 Point anywhere in the row for ID 1.

3 Right-click to open the context menu for this verification.



4 Select **View log file**.

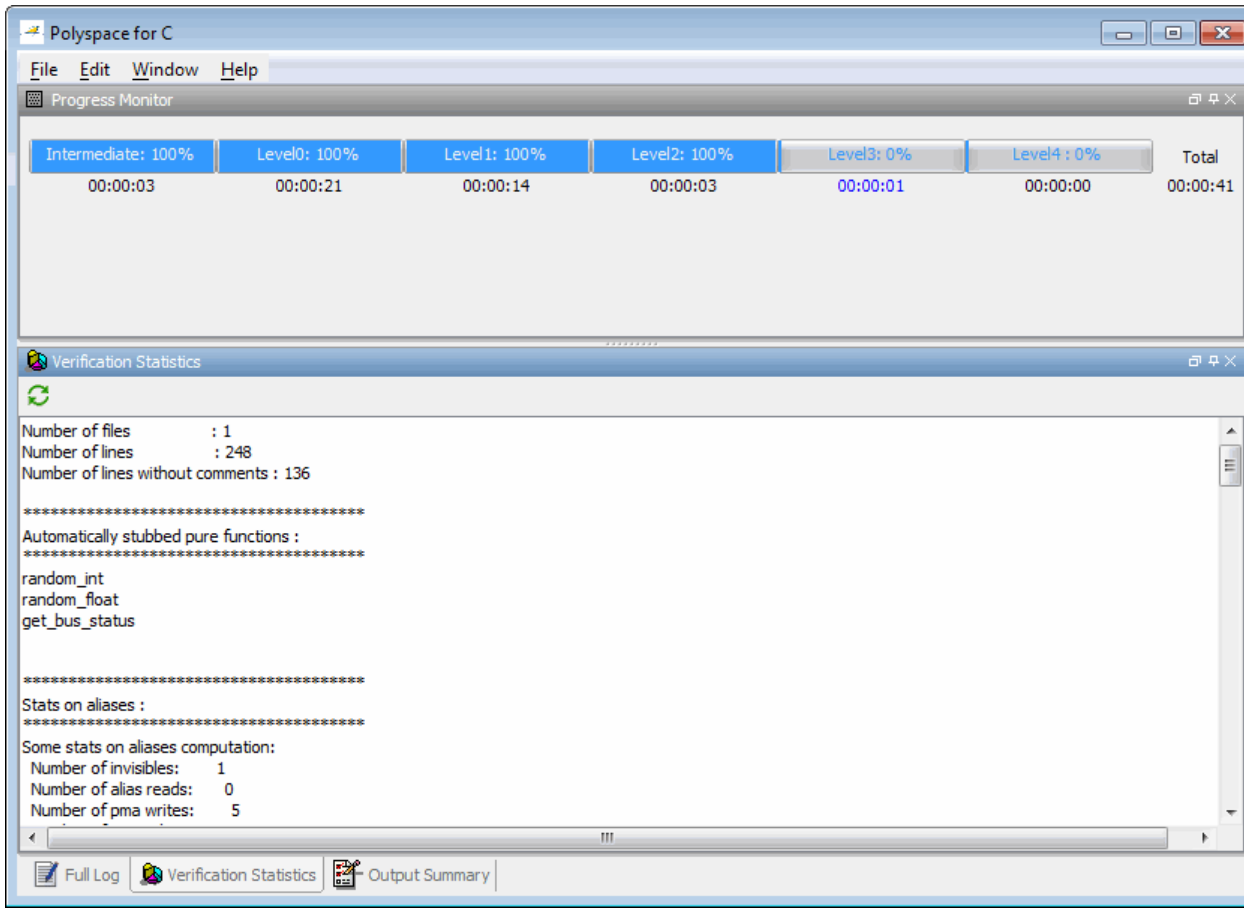
A window opens displaying the last one-hundred lines of the verification.



5 Click **Close** to close the window.

6 Select **Follow Progress** from the context menu.

The Progress Monitor opens.



You can monitor the progress of the verification by watching the progress bar and viewing the logs at the bottom of the window. The progress monitor highlights the current phase in blue and displays the amount of time and completion percentage for that phase.

The logs report additional information about the progress of the verification. To view a log, click the button for that log. The information appears in the log display area at the bottom of the Project Manager window. Follow the next steps to view the logs:

- Click the **Output Summary** tab to display compile phase messages and errors. You can search the log by entering search terms in the **Search in the log** box and clicking the left arrows to search backward or the right arrows to search forward.
- Click the **Verification Statistics** tab to display statistics, such as analysis options, stubbed functions, and the verification checks performed.
- Click the **Refresh** button  to update the display as the verification progresses.
- Click the **Full Log** tab to display messages, errors, and statistics for all phases of the verification.

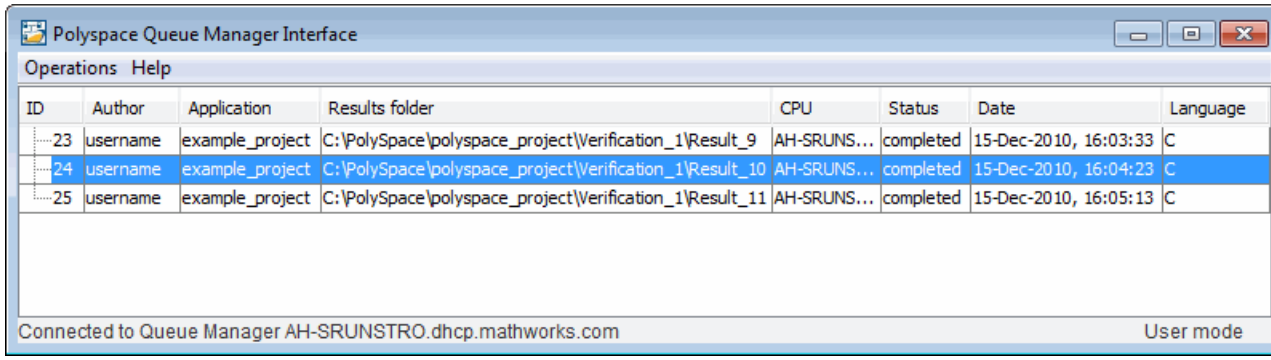
Note You can search the logs. In the **Search in the log** box, enter a search term and click the left arrows to search backward or the right arrows to search forward.

---

7 Select **File > Quit** to close the progress window.

8 Wait for the verification to finish.

When the verification is complete, the status in the Polyspace Queue Manager Interface changes from `running` to `completed`.



Removing Verification Results from the Server

At the end of a server verification, the server automatically downloads verification results to the results folder specified in the project. You do not need to manually download your results.

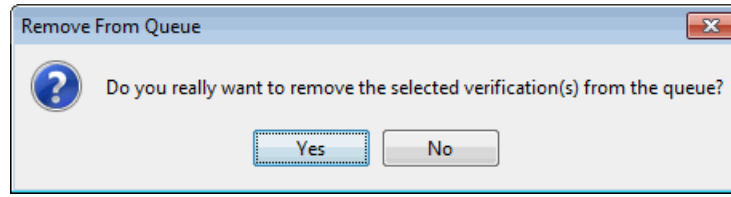
Note You can manually download verification results to another location on your client system, or to other client systems.

Verification results remain on the server until you remove them. Once your results have been downloaded to the client, you can remove them from the server queue.

To remove your results from the server:

1. In the Polyspace Queue Manager Interface, right-click the verification, and select **Remove From Queue**.

   A dialog box opens to confirm that you want to remove the verification from the queue.



2. Click **Yes**.

   Note To download the results and remove the verification from the queue, right-click the verification and select **Download Results And Remove From Queue**. If you download results before the verification is complete, you get partial results and the verification continues.

3. Select **Operations > Exit** to close the Polyspace Queue Manager Interface.

Once the results are on your client, you can review them using the Run-Time Checks perspective. You review results from the verification in Chapter 4, “Reviewing Verification Results”.

Troubleshooting a Failed Verification

When you see a message that the verification failed, it indicates that Polyspace software could not perform the verification. The following sections present some possible reasons for a failed verification.

Hardware Does Not Meet Requirements

If your computer does not have the minimum hardware requirements. the verification fails. For information about the hardware requirements, go to:

`www.mathworks.com/products/polyspaceclientc/requirements.html`.

To determine if this is the cause of the failed verification, search the log for the message:

```
Errors found when verifying host configuration.
```

You can:

- Upgrade your computer to meet the minimal requirements.
- In the General section of the Analysis options, select the **Continue with current configuration option** and run the verification again.

You Did Not Specify the Location of Include Files

If you see a message in the log, such as the following, either the files are missing or you did not specify the location of include files.

```
include.h:  No such file or folder
```

For information on how to specify the location of include files, see “Creating a New Project to Verify the Example C File” on page 2-7.

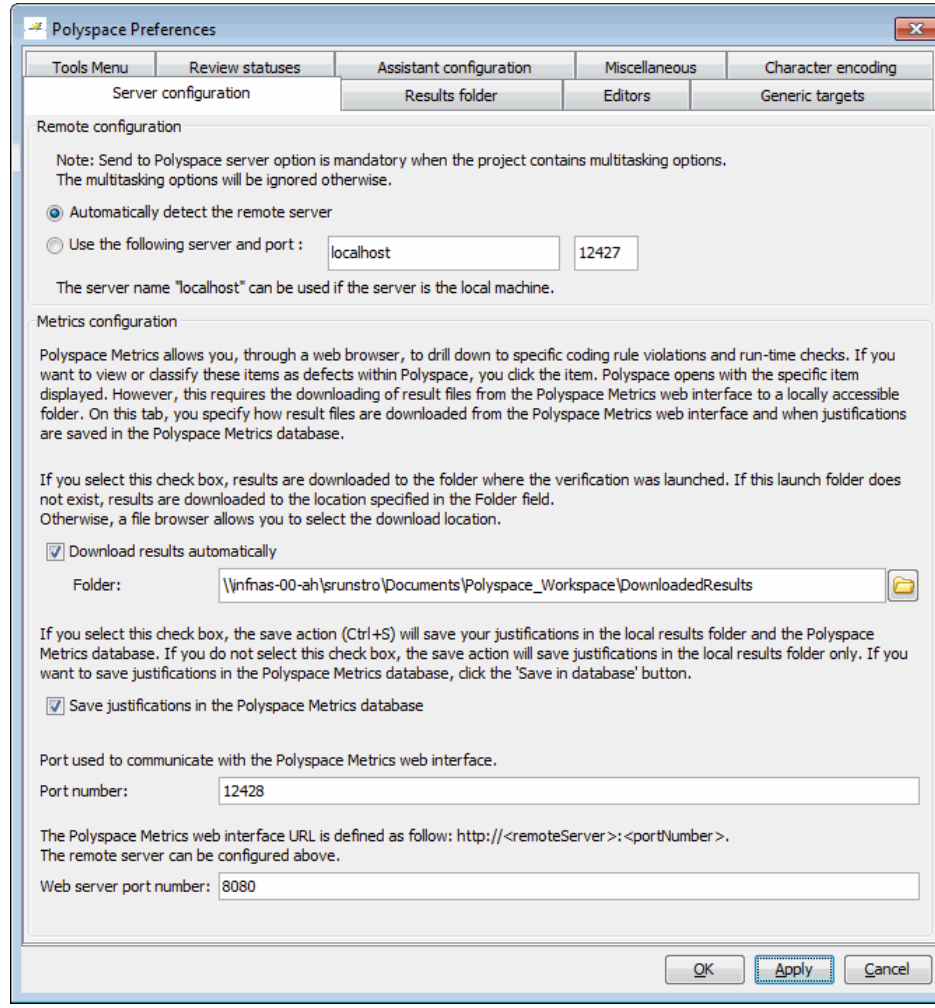
Polyspace Software Cannot Find the Server

If you see the following message in the log, Polyspace software cannot find the server.

```
Error:  Unknown host :
```

Polyspace software uses information in the preferences to locate the server. To find the server information in the preferences:

1. Select **Options > Preferences**.
2. Select the **Server Configuration** tab.



By default, Polyspace software automatically finds the server. You can specify the server by selecting **Use the following server and port** and providing the server name and port. For information about setting up a server, see the *Polyspace Installation Guide*.

Using Polyspace In One Click to Launch Verification

In this section...

Overview of Polyspace In One Click

In a Microsoft Windows environment, Polyspace software provides a convenient way to streamline your work when you want to verify several files using the same set of options. Once you have set up a project file that has the options that you want, you designate that project as the *active project*, and then send the source files to Polyspace software for verification. You do not have to update the project with source file information. This process is called *Polyspace In One Click*.

In this part of the tutorial, using Polyspace In One Click, you learn how to:

1. Set the active project.
2. Send files to Polyspace software for verification.

Setting the Active Project

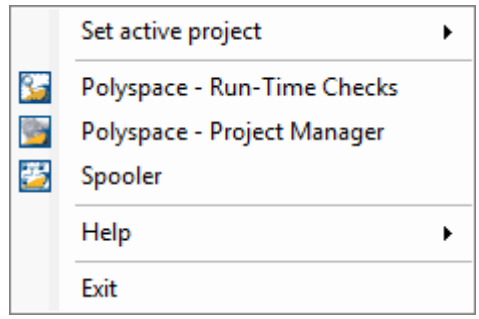
The active project is the project that Polyspace In One Click uses to verify the files that you select. Once you have set an active project, it remains active until you change the active project. Polyspace software uses the analysis options from the project; it does not use the source files or results folder from the project.

To set the active project:

1. In the taskbar area of your Windows desktop, right-click the Polyspace In One Click icon:

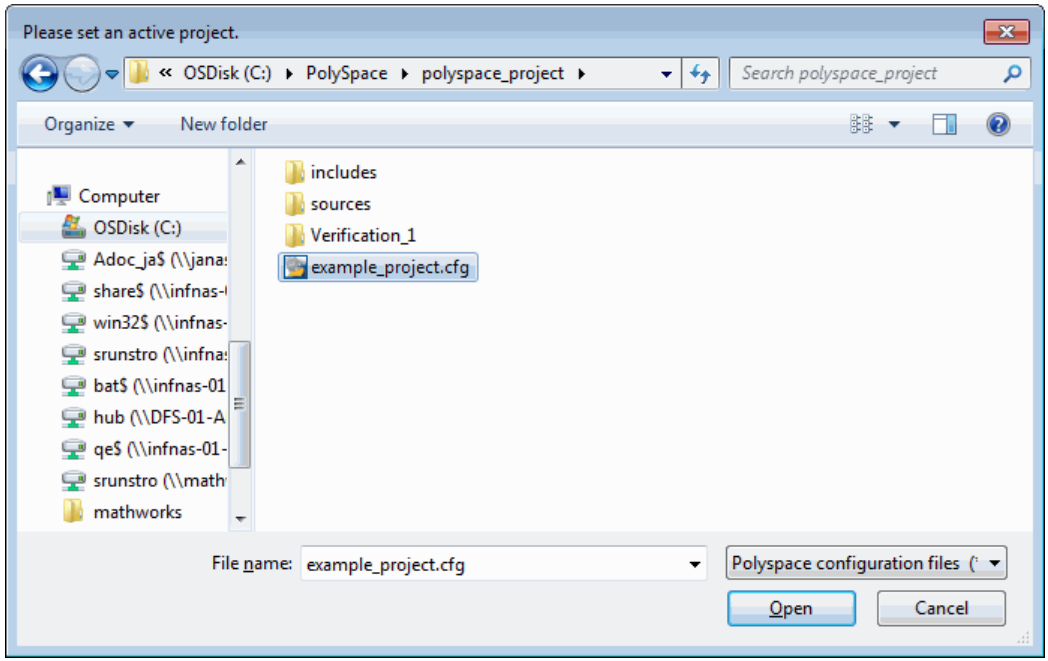
   

   The context menu appears.



2 Select **Set active project > Browse**.

The Please set an active project dialog box opens.



3 Navigate to `polyspace_project`.

4 Select `example_project.cfg`.

5 Click **Open** to apply the changes and close the dialog box.

Sending Files to Polyspace Software

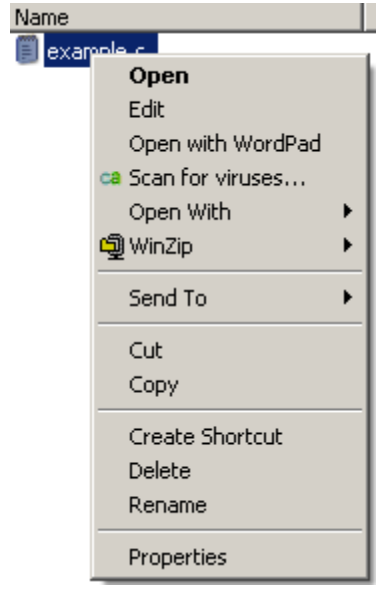
You can send several files to Polyspace software for verification. For this tutorial, you send one file, `example.c`.

To send `example.c` to Polyspace software for verification:

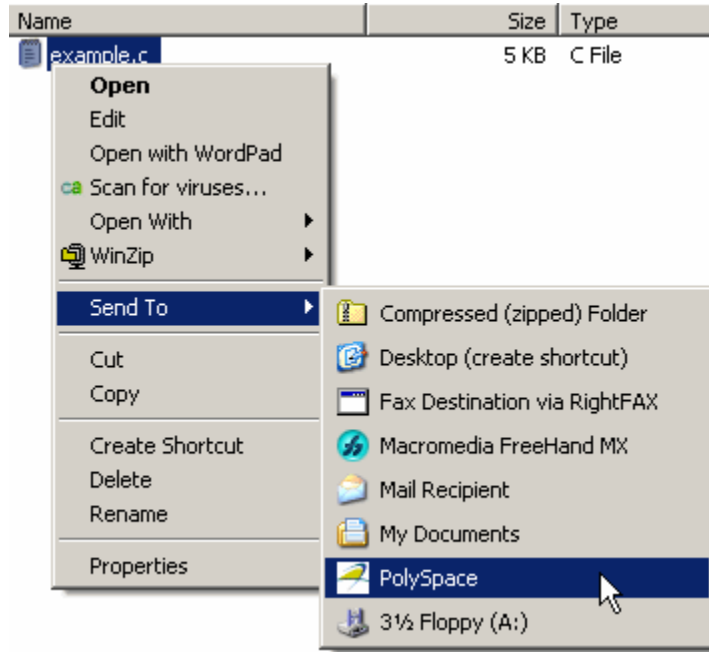
1 Navigate to the folder `polyspace_project\sources`.

2 Right-click the file `example.c`.

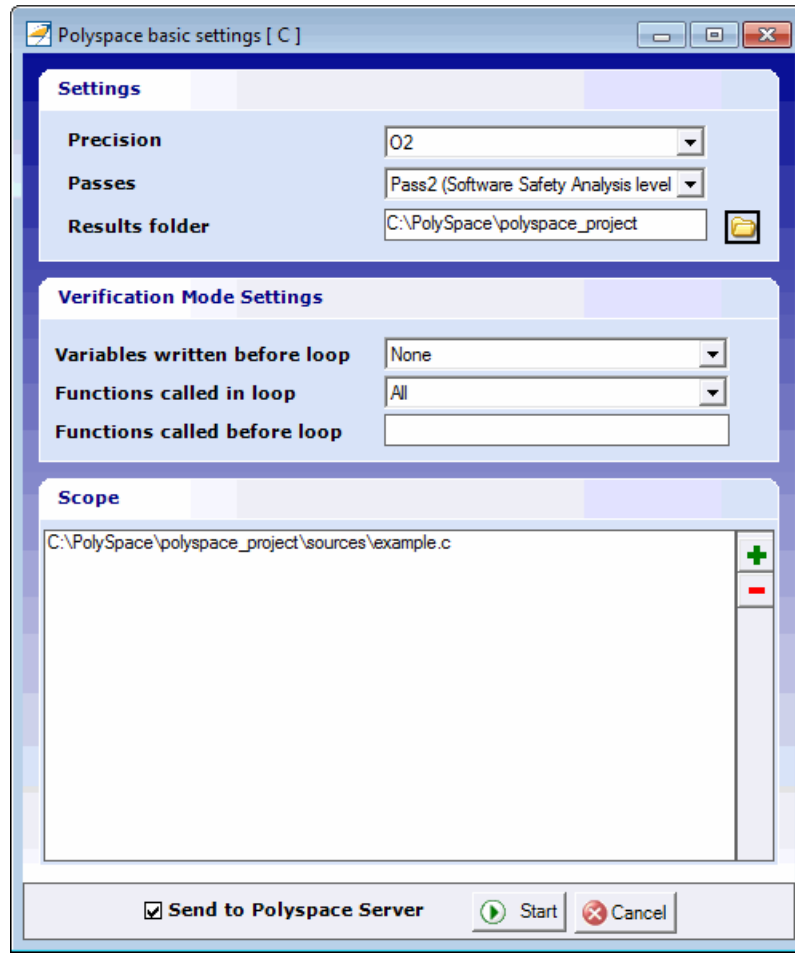
The context menu appears.



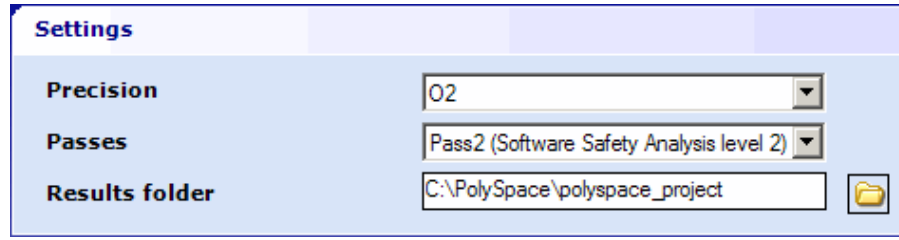
3 Select **Send To > Polyspace**.



The Polyspace basic settings dialog box appears.



4 Make sure that the **Results folder** is `polyspace_project`.

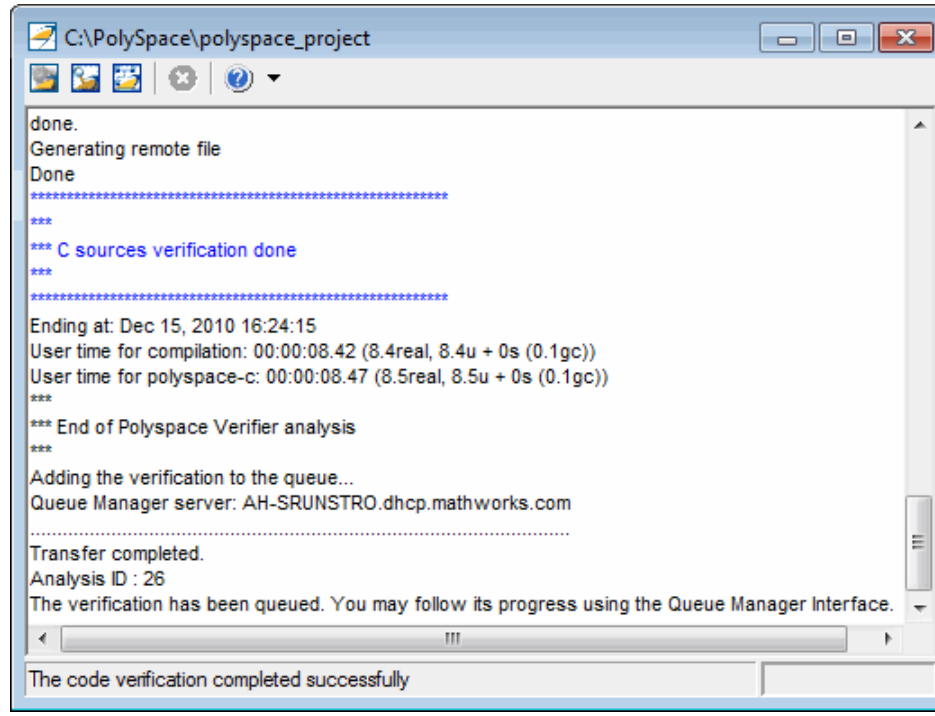


5 If the **Send to Polyspace Server** option is not already selected, select it.

6 Leave the default values for the other parameters.

Click **Start**.

The verification log opens.



The compile phase of the verification runs on the client. When the compile phase is complete:

- You see the following message in the log:

  ```
  End of Polyspace Verifier analysis
  ```

- A message in the log states that the verification was transferred to the server and gives you the identification number (Analysis ID) for the verification. For this verification, the identification number is `1`.

- Monitor the verification using the Spooler. For information on using the Spooler to monitor a verification on a server, see “Monitoring Progress Using Queue Manager” on page 3-14.
- When the verification is complete, download the results to `polyspace_project\results`. For information on downloading results from a server to a client, see “Removing Verification Results from the Server” on page 3-19

  You review the results in Chapter 4, “Reviewing Verification Results”.

Launching Client Verification from Project Manager

In this section...

Starting the Verification

For the best performance, run verifications on a server. If the server is busy or you want to verify a small file, you can run a verification on a client.

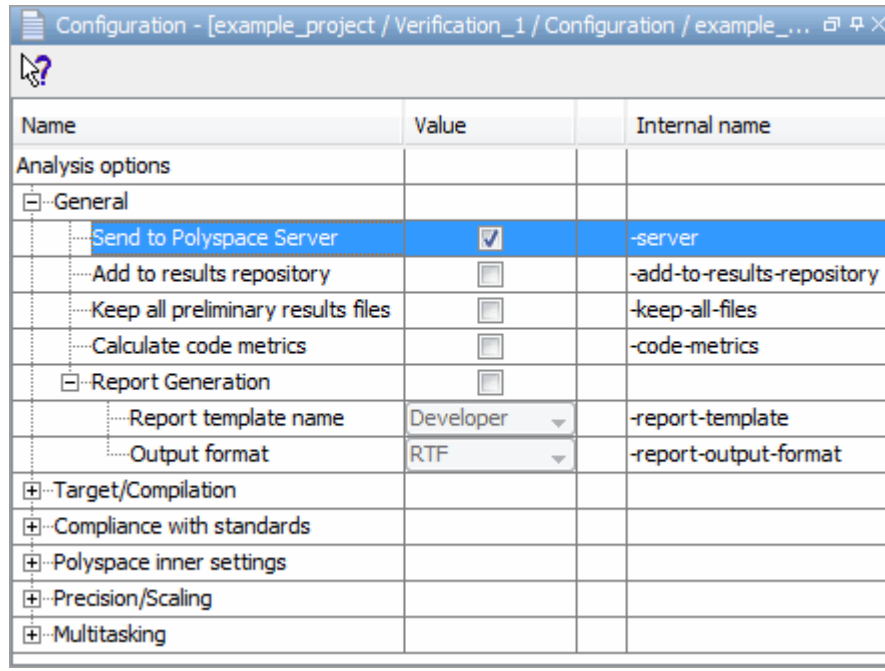
Note Because a verification on a client can process only a limited number of variable assignments and function calls, the source code should have no more than 800 lines of code.

To start a verification that runs on a client:

1. If the project `example_project.cfg` is not already open, open the project.

   For information about opening a project, see "Preparing for Verification" on page 3-4.

2. Clear the **Send to Polyspace Server** check box in the General Analysis options.



3 If you see a warning that multitasking is not available when you run a verification on the client, click **OK** to continue and close the message box. This warning appears only when you clear the **Send to Polyspace Server** check box.

4 Click the **Run** button 

on the Project Manager toolbar.

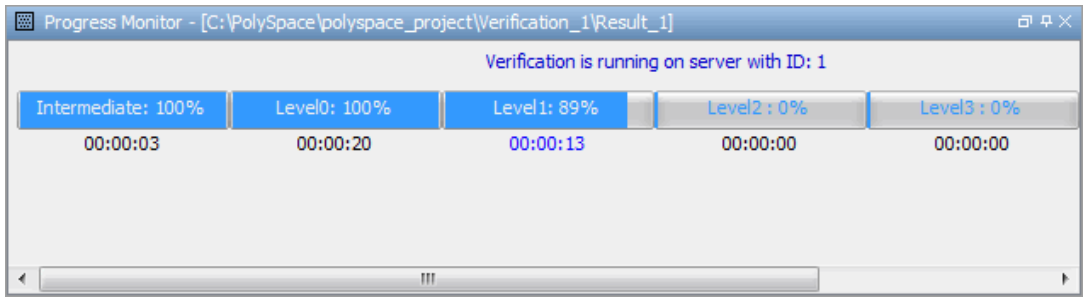
5 If you see a caution that Polyspace software will remove existing results from the results folder, click **Yes** to continue and close the message dialog box.

The Output Summary and Progress Monitor windows become active, allowing you to monitor the progress of the verification.

Note If you see the message `Verification process failed`, click **OK** and go to "Troubleshooting a Failed Verification" on page 3-20.

Monitoring the Progress of the Verification

You can monitor the progress of the verification by viewing the progress monitor and logs at the bottom of the Project Manager perspective.



The progress monitor highlights the current phase in blue and displays the amount of time and completion percentage for that phase.

The logs report additional information about the progress of the verification. To view a log, click the button for that log. The information appears in the log display area at the bottom of the Project Manager window. Follow the next steps to view the logs:

1. Click the **Output Summary** tab to display compile phase messages and errors. You can search the log by entering search terms in the **Search in the log** box and clicking the left arrows to search backward or the right arrows to search forward.

2. Click the **Verification Statistics** tab to display statistics, such as analysis options, stubbed functions, and the verification checks performed.

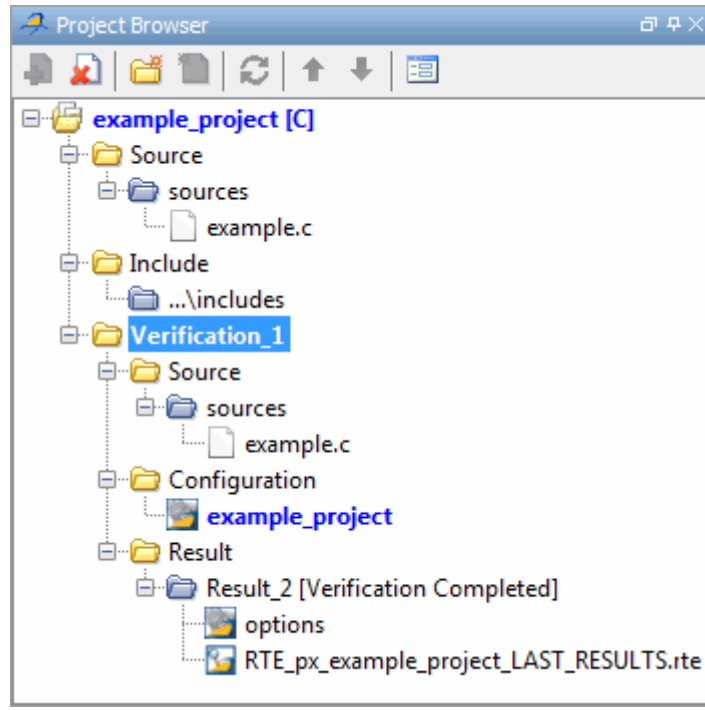
3. Click the **Refresh** button  to update the display as the verification progresses.

4. Click the **Full Log** tab to display messages, errors, and statistics for all phases of the verification.

Note You can search the logs. In the **Search in the log** box, enter a search term and click the left arrows to search backward or the right arrows to search forward.

Completing Verification

When the verification is complete, the message "`Verification Completed`" appears at the bottom of the Project Manager window, and the results appear in the Project Browser.



In the tutorial Chapter 4, "Reviewing Verification Results", you open the Run-Time Checks perspective and review the verification results.

Stopping the Verification Before It is Complete

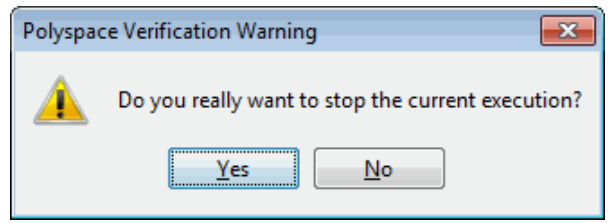
You can stop the verification before it is complete. If you stop the verification, results are incomplete. If you start another verification, the verification starts over from the beginning.

To stop a verification:

1. Click the **Stop** button 

on the Project Manager toolbar.

   A warning dialog box opens.



2. Click **Yes**.

   The verification stops and the message `Verification process stopped` appears.

3. Click **OK** to close the **Message** dialog box.

Note Closing the Polyspace verification environment window does *not* stop the verification. To resume display of the verification progress, start the Polyspace software and open the project.

4

Reviewing Verification Results

About Reviewing Verification Results Tutorial

In this section...

Overview

In the previous tutorial, Chapter 3, "Running a Verification" , you completed a verification of `example.c`. In this tutorial, you explore the verification results.

The Polyspace verification environment contains a Run-Time Checks perspective that you use to review results. In this tutorial, you learn:

1. How to use the Run-Time Checks perspective, including how to:
   - Open the Run-Time Checks perspective and view verification results.
   - Explore results in expert mode.
   - Explore results in assistant mode.
   - Generate reports.
2. How to interpret the color-coding that Polyspace software uses to identify the severity of an error.
3. How to find the location of an error in the source code.

Before You Start

Before starting this tutorial, be sure to complete the tutorial Chapter 3, "Running a Verification".

In this tutorial, you use the verification results in this file:

```
polyspace_project\Verification_(1)\Result_(1)\
RTE_px_example_project_LAST_RESULTS.rte.
```

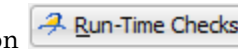
Opening Verification Results

In this section...

Opening Run-Time Checks Perspective

You use the Run-Time Checks perspective to review verification results.

To open the Run-Time Checks perspective:

- Select the **Run Time Checks** button 

in the Polyspace Verification Environment toolbar.

Opening Verification Results

To open the verification results:

1. Select **File > Open Result**.

   The Please select a file dialog box opens.

2. Navigate to the results folder:

   `polyspace_project\Verification_(1)\Result_(1)`.

3. Select the file `RTE_px_example_project_LAST_RESULTS.rte`.

4. Click **Open**.

   The results appear in the Run-Time Checks perspective.

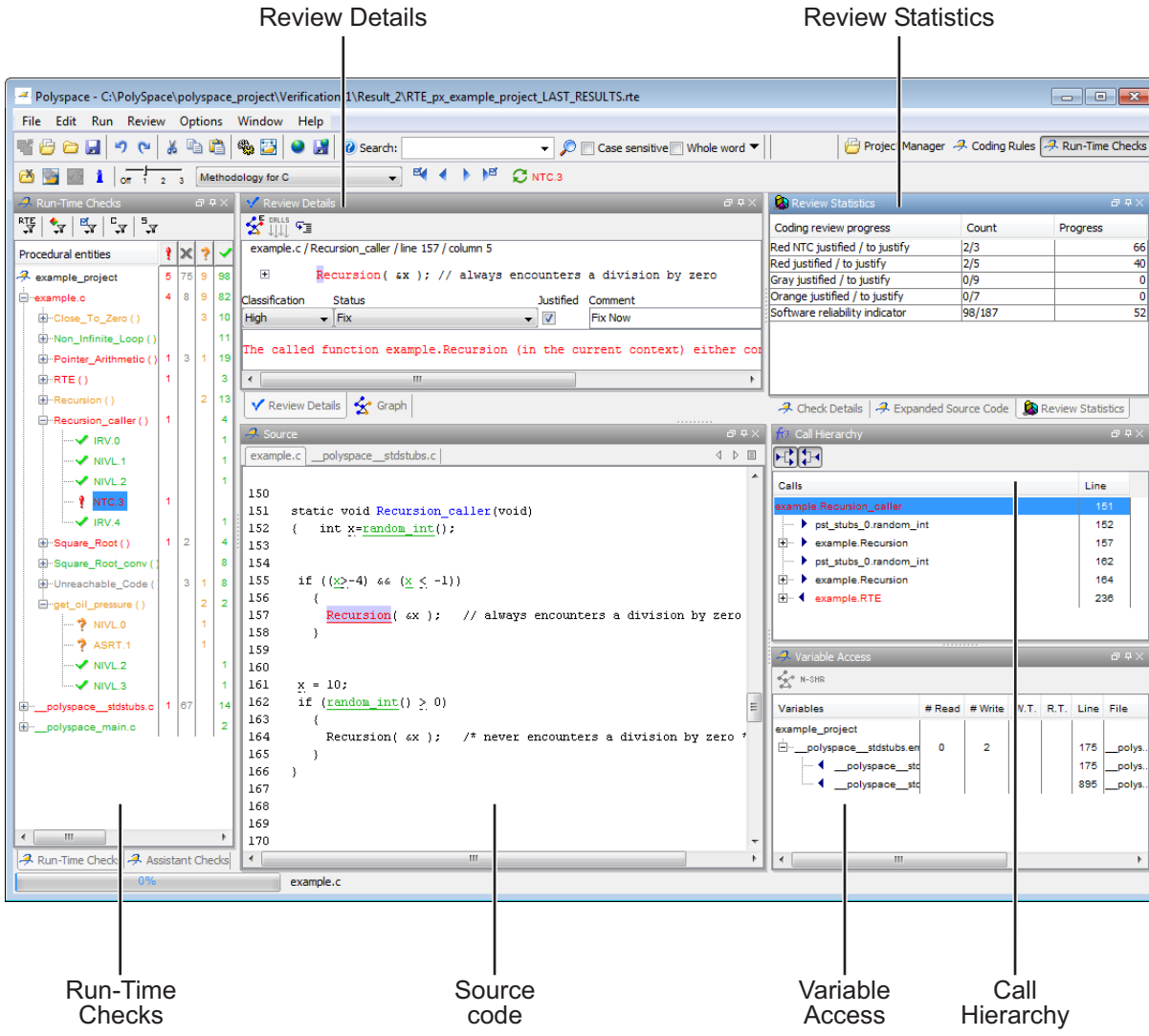
Note You can also open results from the Project Manager perspective by double-clicking the results file in the Project Browser.

Exploring Run-Time Checks Perspective

In this section...

Overview

The Run-Time Checks perspective looks like the following figure.



The Run-Time Checks perspective has six sections below the toolbar. Each section provides a different view of the results. The following table describes these views.

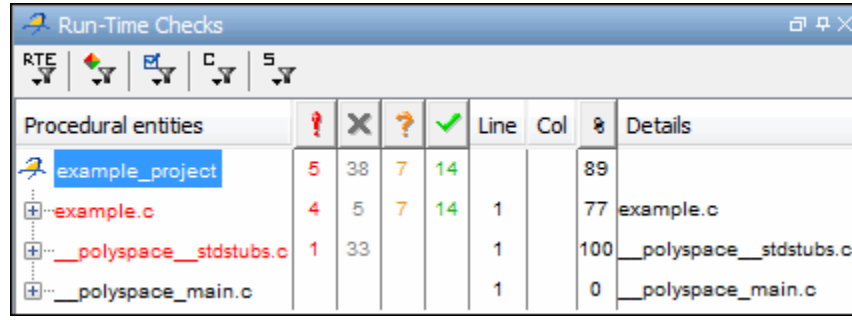
This Pane...	Displays...
Run-Time Checks (Procedural entities view)	List of the checks (diagnostics) for each file and function in the project
Source (Source code view)	Source code for a selected check in the procedural entities view
Review Statistics (Coding review progress view)	Statistics about the review progress for checks with the same type and category as the selected check
Review Details (Selected check view)	Details about the selected check
Variable Access (Variables view)	Information about global variables declared in the source code
Call Hierarchy (Call tree view)	Tree structure of function calls

You can resize or hide any of these sections. You learn more about the Run-Time Checks perspective later in this tutorial.

Reviewing the Run-Time Checks Pane

The Run-Time Checks pane displays a table with information about the diagnostics for each file in the project. The Run-Time Checks pane is also called the Procedural entities view

When you first open the results file from the verification of `example.c`, you see the following procedural entities.



The file `example.c` is red because it has a run-time error. Polyspace software assigns each file the color of the most severe error found in that file. The first column of the table in the Procedural Entities View is the procedural entity (the file or function). The following table describes some of the other columns in the procedural entities view.

Column Heading	Indicates
	Number of red checks (operations where an error always occurs)
	Number of gray checks (unreachable code)
	Number of orange checks (warnings for operations where an error might occur)
	Number of green checks (operations where an error never occurs)
	Selectivity of the verification (percentage of checks that are not orange) This is an indication of the level of proof.

Note You can select which columns appear in the procedural entities view by editing the preferences.

What you select in the procedural entities view determines what you see in the other views. In the following examples, you learn how to use the views and how they interact.

Reviewing Results in Manual Mode

In this section...

What Is Manual Mode?

In manual mode, you see all checks in the Run-Time Checks perspective. You decide which checks to review and in what order to review them.

Switching to Manual Mode

By default, the Run-Time Checks perspective opens in assistant mode. To switch from assistant to manual mode:

- Move the Assistant slider to **Off** in the Run-Time Checks toolbar.

  The toolbar displays buttons and menus specific to expert mode.

Reviewing Checks in Manual Mode

In this part of the tutorial, you learn how to use the Run-Time Checks perspective to examine verification checks. This part of the tutorial covers:

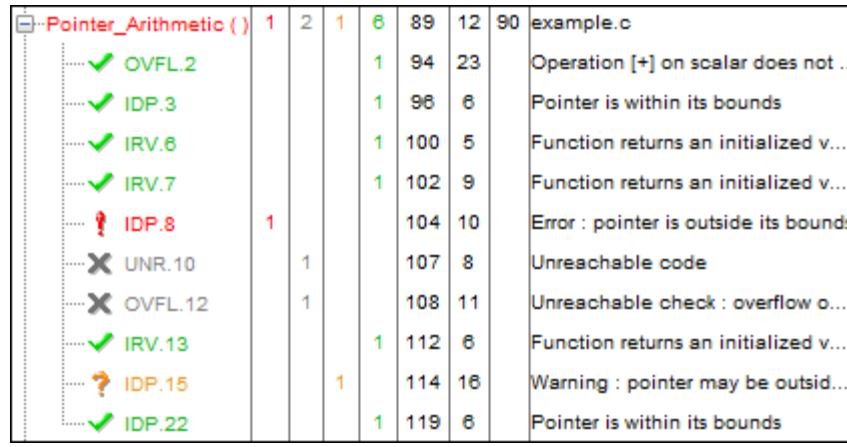
- "Selecting a Check to Review" on page 4-9
- "Displaying the Calling Sequence" on page 4-11
- "Tracking Review Progress" on page 4-11

Selecting a Check to Review

In the procedural entities view, `example.c` is red, indicating that this file has at least one red check. To review a red check in `example.c`:

1. In the procedural entities section of the Run-Time Checks pane, expand `example.c`.
2. Expand the red procedure `Pointer_Arithmetic()`.

   A color-coded list of the checks performed on `Pointer_Arithmetic()` opens.

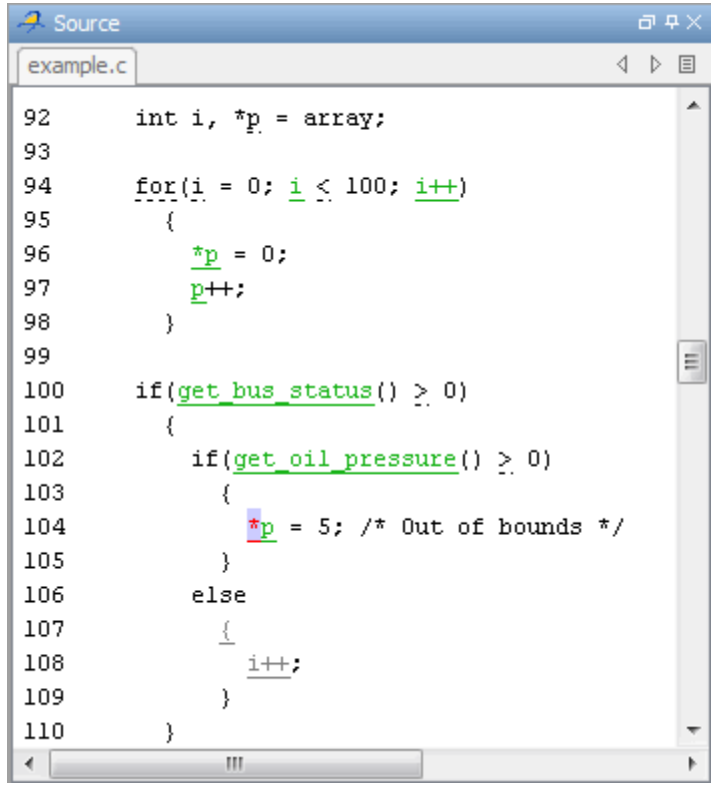


Pointer_Arithmetic ( )	1	2	1	6	89	12	90	example.c
OVFL.2				1	94	23		Operation [+] on scalar does not ...
IDP.3				1	96	6		Pointer is within its bounds
IRV.6				1	100	5		Function returns an initialized v...
IRV.7				1	102	9		Function returns an initialized v...
IDP.8	1				104	10		Error : pointer is outside its bounds
UNR.10		1			107	8		Unreachable code
OVFL.12		1			108	11		Unreachable check : overflow o...
IRV.13				1	112	6		Function returns an initialized v...
IDP.15			1		114	16		Warning : pointer may be outsid...
IDP.22				1	119	6		Pointer is within its bounds

   In the list of checks, each item has an acronym that identifies the type of check and a number. For example, in `IDP.8`, IDP stands for Illegal Dereferenced Pointer. For more information, see "Check Descriptions" in the *Polyspace Products for C Reference*.

3. Click the red `IDP.8`.

   The Source pane displays the section of source code where this error occurs.



4 At line 104 of the code, click the red code.

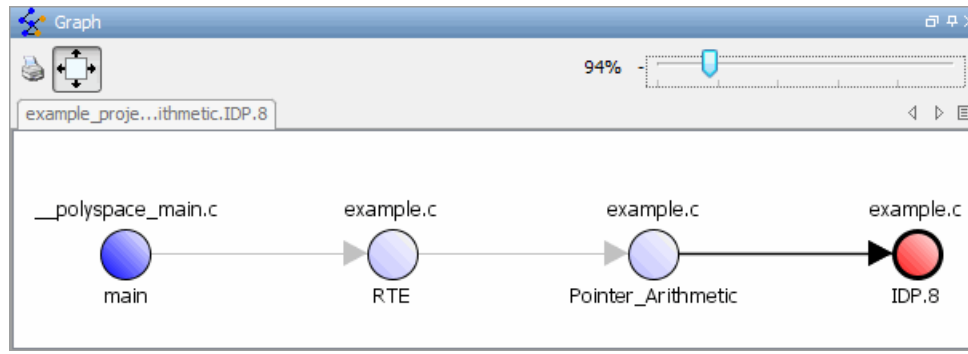
An error message box opens indicating that when the pointer `p` is dereferenced, it is outside of its bounds. At line 92, `p` points to the start of `array` which has 100 elements. The `for` loop starting at line 94 initializes the elements of `array` to 0. This `for` loop leaves `p` pointing to the location after the last element of `array`.

Displaying the Calling Sequence

You can display the calling sequence that leads to the code associated with a check. To see the calling sequence for the red `IDP.8` check in `Pointer_Arithmetic()`:

1. Expand `Pointer_Arithmetic()`.
2. Click the red `IDP.8`.
3. Click the **call graph** button  in the Review Details toolbar.

   A window displays the call graph.



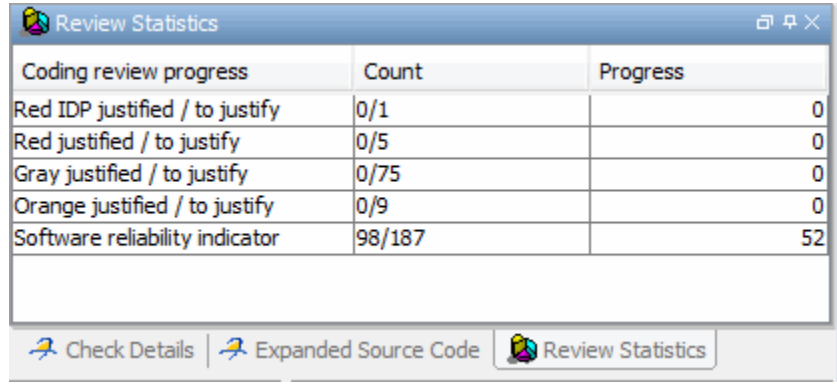
   The code associated with `IDP.9` is in `Pointer_Arithmetic`. The generated `main` function calls `RTE`, which calls `Pointer_Arithmetic`.

Tracking Review Progress

You can keep track of the checks that you have reviewed by marking them. To mark that you have reviewed the red `IDP.8` check in `Pointer_Arithmetic()`:

1. Expand `Pointer_Arithmetic()`.
2. Click the red `IDP.8`.

   The Review Statistics pane displays a table with statistics about the review progress for that category and severity of error.



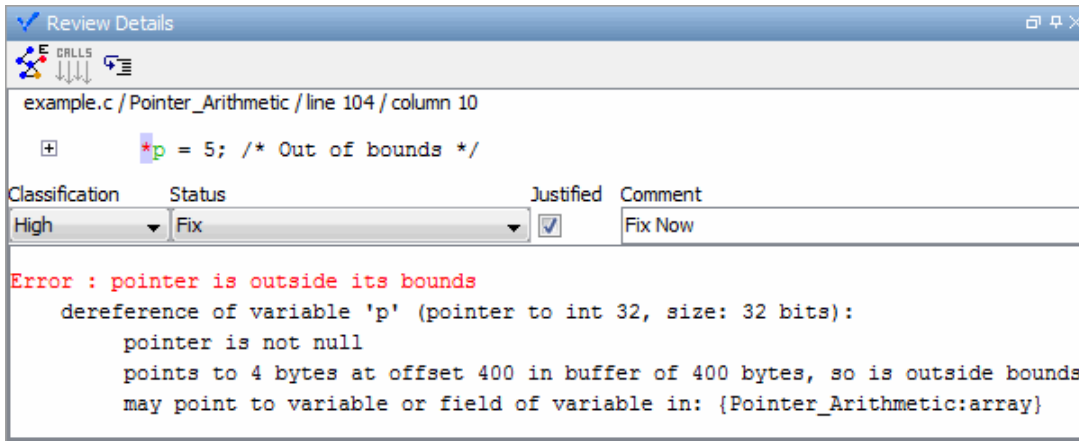
The **Count** column displays a ratio and the **Progress** column displays the equivalent percentage.

The first row displays the ratio of justified checks to total checks that have the same color and category as the current check. In this example, the first row displays the ratio of reviewed red IDP checks to total red IDP errors in the project.

The second row displays the ratio of justified checks to total checks that have the same color as the current check. In this example, this ratio is the ratio of red errors reviewed to total red errors in the project.

The last row displays the ratio of the number of green checks to the total number of checks, providing an indicator of the reliability of the software.

Information about the current check (the red `IDP.8`) appears in the Review Details window (Selected Check view).



3. After you review the check, select a **Classification** to describe the seriousness of the issue:

   - `High`
   - `Medium`
   - `Low`
   - `Not a defect`

4. Select a **Status** to describe how you intend to address the issue:

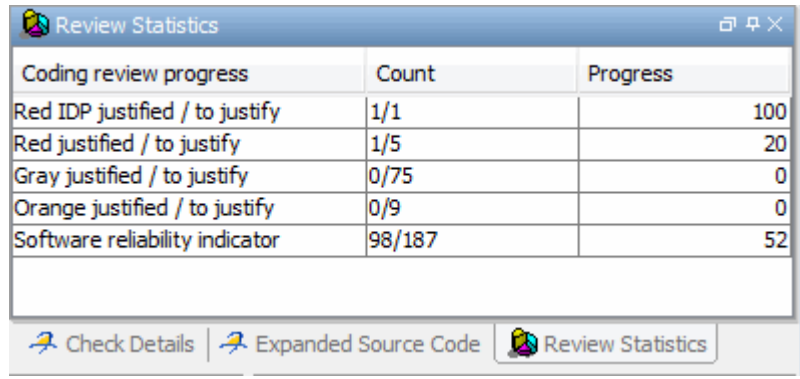
   - `Fix`
   - `Improve`
   - `Investigate`
   - `Justify with annotations`
   - `No Action Planned`
   - `Other`
   - `Restart with different options`
   - `Undecided`

Note You can also define your own statuses. See “Defining Custom Status ”.

5 In the comment box, enter additional information about the check.

6 Select the check box to indicate that you have justified this check.

The **Coding review progress** part of the window updates the ratios of errors reviewed to total errors.



Reviewing Additional Examples of Checks

In this part of the tutorial, you learn about other types and categories of errors by reviewing the following examples in `example.c`:

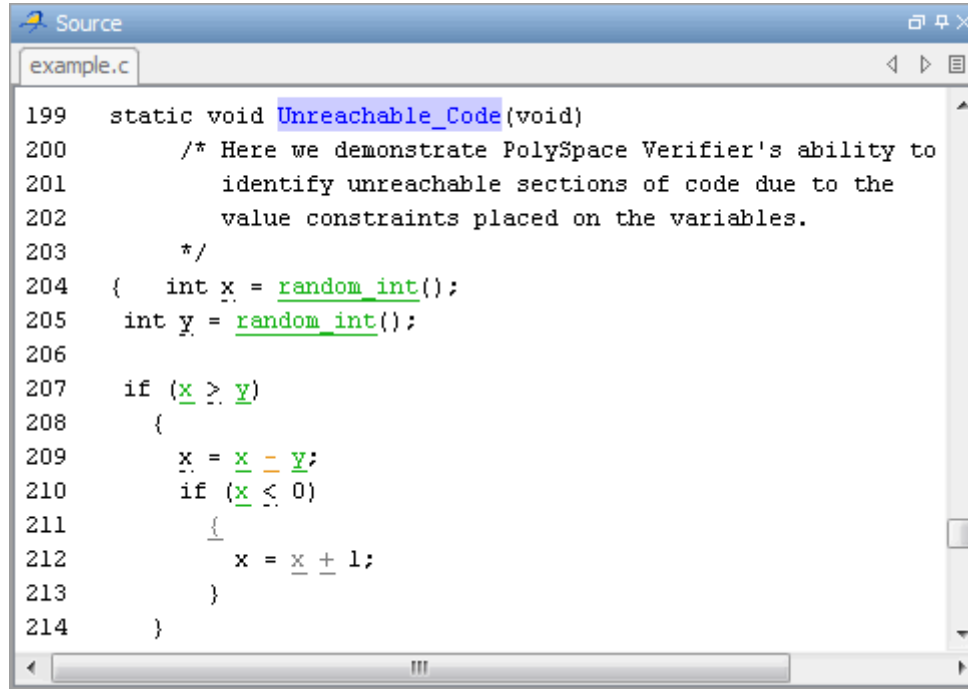
- “Example: Unreachable Code” on page 4-15
- “Example: Arithmetic Error” on page 4-16
- “Example: A Function with No Errors” on page 4-17
- “Example: Division by Zero” on page 4-17

Example: Unreachable Code

Unreachable code is code that never executes. Polyspace software displays unreachable code in gray. In the following example, you look at an example of unreachable code.

1 In **Procedural Entities**, click `Unreachable_Code()`.

The source code view displays the source code for this function.



2 Examine the source code.

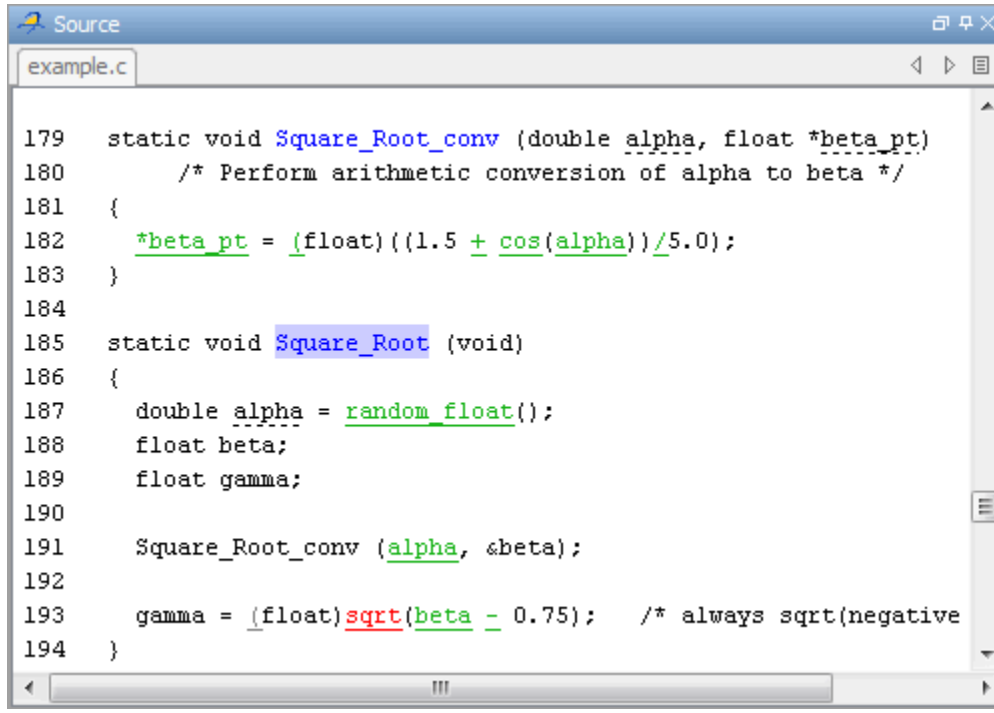
At line 212, the code `x = x +1` is never reached because the condition `x < 0` is always false.

Example: Arithmetic Error

In the following example, Polyspace software detects a memory corruption error:

1. In Procedural entities, expand the red `Square_Root()` function.

   The source code view displays the source code for this function.



2. Examine the source code.

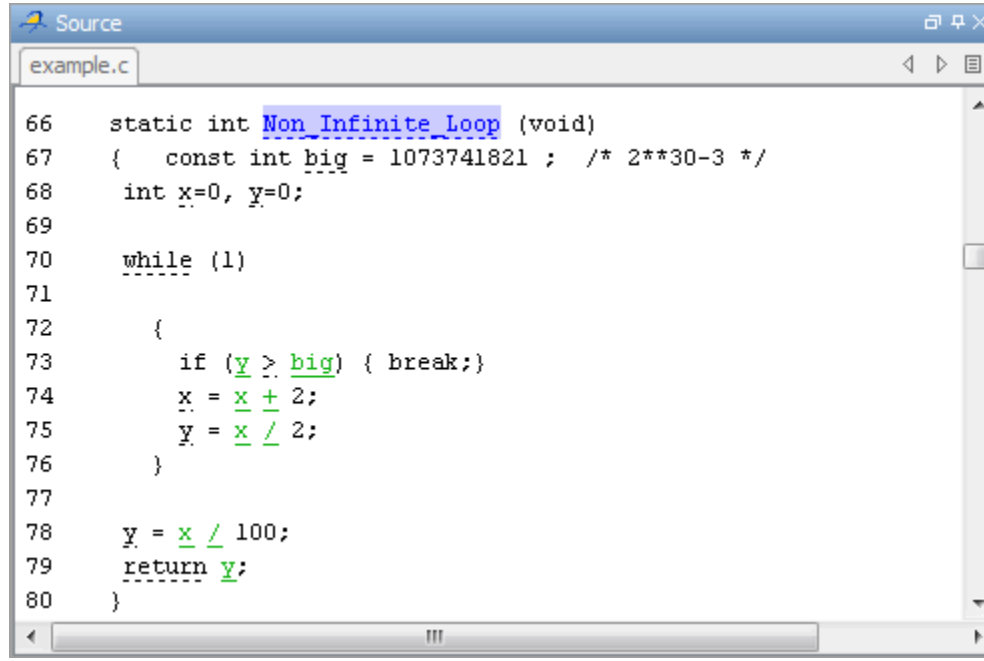
   Because `beta` is always less than 0.75, the argument to the `sqrt()` function at line 193 is always negative.

Example: A Function with No Errors

In the following example, Polyspace software verifies code with a large number of iterations, and determines that the loop terminates and a variable does not overflow:

1 In Procedural entities, click the green `Non_Infinite_Loop()` function.

The source code view displays the source code for this function.



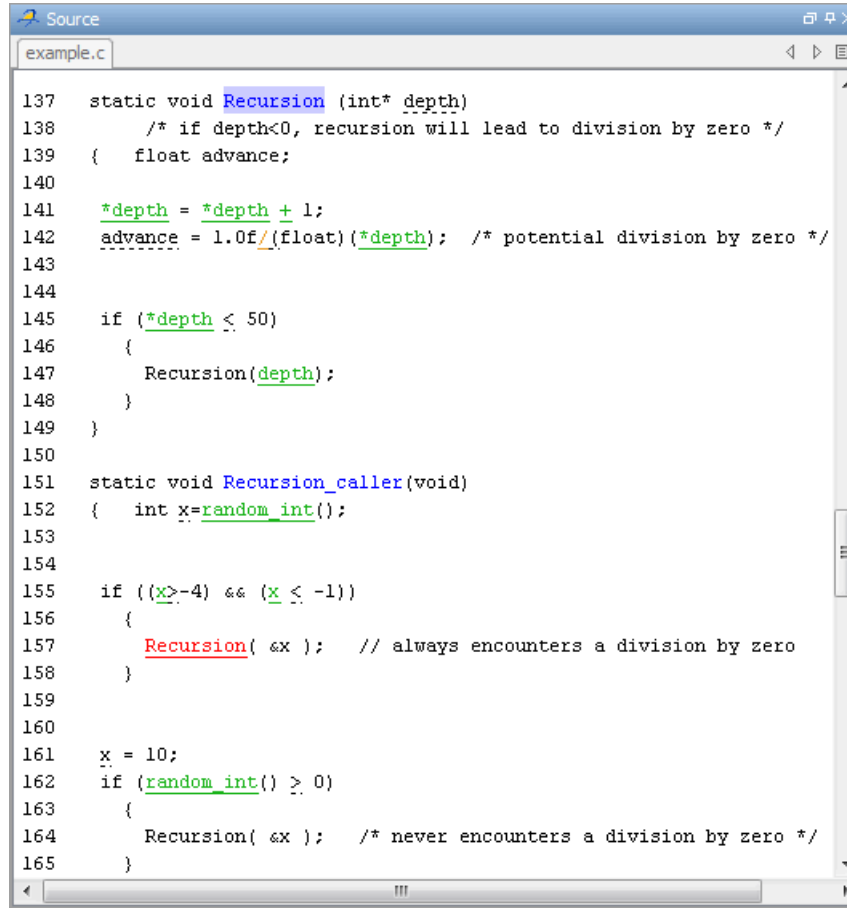
2 Examine the source code. The variable `x` never overflows because the `while` loop at line `70` terminates before x can overflow.

Example: Division by Zero

In the following example, Polyspace software detects division by zero:

1 In Procedural entities, expand `Recursion()`.

The source code view displays the source code for this function.



2 Examine the `Recursion()` function.

When `Recursion()` is called with `depth` less than zero, the code at line `142` results in division by zero. The orange color indicates that this operation is a potential error (depending on the value of `depth`).

3 Examine the red `Recursion_caller` function.

The first call to `Recursion() at line 157` is red because it calls `Recursion()` with `depth` less than zero, causing a division by zero. The

second call to `Recursion()` at line `164` does not cause division by zero because it calls `Recursion()` with `depth` greater than zero.

Filtering Checks

You can filter the checks that you see in the Run-Time Checks perspective so that you can focus on certain checks. Polyspace software allows you to filter your results in several ways. You can filter by:

- Check category (ZDV, IDP, NIP, etc.)
- Color of check (gray, orange, green)
- Justified or unjustified
- Classification
- Status

To filter checks, select one of the filter buttons in the Run-Time checks toolbar.

Tip The tooltip for a filter button describes what filter the button activates.

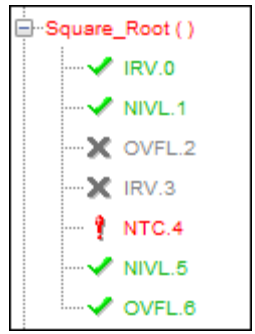
Example: Filtering IRV Checks

You can use an RTE filter to hide a given check category, such as IRV. When a filter is enabled, you do not see that check category.

To filter IRV checks:

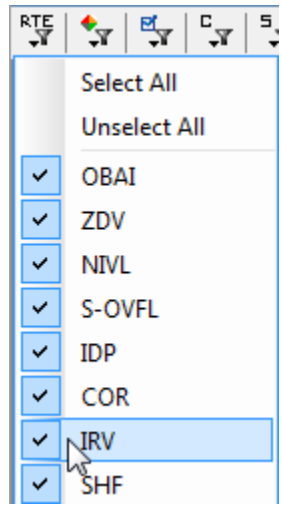
1. Expand `Square_Root()`.

   `Square_Root()`has seven checks: four are green, one is red, and two are gray.

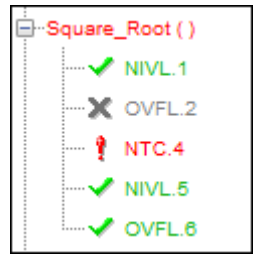


2 Click the **RTE filter** icon  .

3 Clear the **IRV** option.



The software hides the IRV check for `Square_Root()`.



4 Select the IRV option to redisplay the IRV check.

Note When you filter a check category, red checks of that category are not hidden. For example, if you filter IDP checks, you still see `IDP.8` under `Pointer_Arithmetic()`.

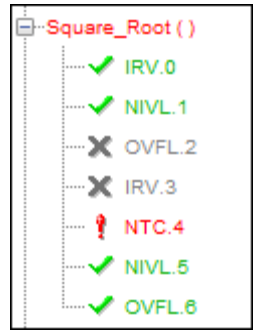
Example: Filtering Green Checks

You can use a Color filter to hide certain color checks. When a filter is enabled, you do not see that color check.

To filter green checks:

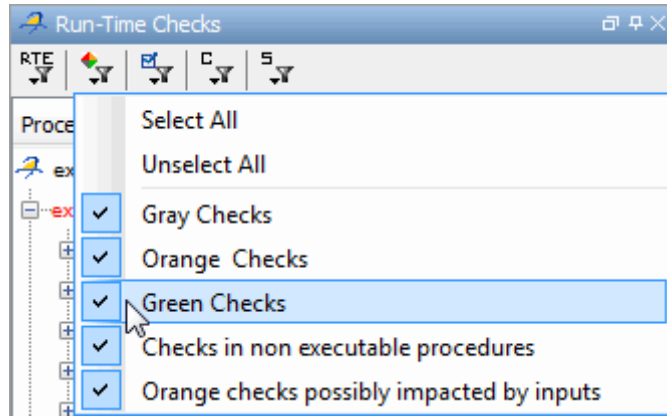
1 Expand `Square_Root()`.

`Square_Root()`has seven checks: four are green, one is red, and two are gray.

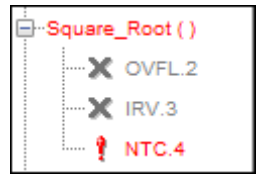


2 Click the **Color filter** icon  .

3 Clear the **Green Checks** option.



The software hides the green checks.



Reviewing Results in Assistant Mode

In this section...

What Is Assistant Mode?

By default, the Run-Time Checks perspective opens in assistant mode. In assistant mode, Polyspace software chooses the checks for you to review and the order in which you review them. Polyspace software presents checks in this order:

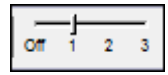
1. All red checks.
2. All blocks of gray checks (the first check in each unreachable function).
3. Orange checks according to the methodology and criterion level you select.

You learn about methodologies and criterion levels in "Selecting the Methodology and Criterion Level" on page 4-24.

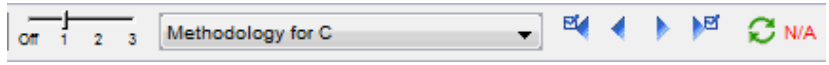
Switching to Assistant Mode

To switch from expert to assistant mode:

- Move the Assistant slider to **1** in the Run-Time Checks toolbar.



The Assistant Checks tab opens, displaying the checks you need to review, and the toolbar displays controls specific to assistant mode.



The controls for assistant mode include:

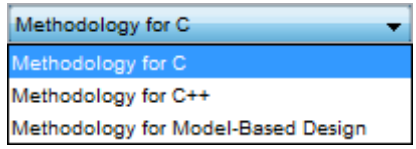
- A menu for selecting the review methodology for orange checks.
- A slider for selecting the criterion level within that methodology.
- Arrows for navigating through the reviews.

Selecting the Methodology and Criterion Level

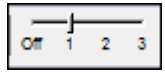
A methodology defines which orange checks you review in assistant mode. Each methodology has three criterion levels, corresponding to different development phases, with increasing review requirements. As the criterion level increases, you review more checks.

To select the methodology and level for this tutorial:

1. Select **Methodology for C** from the methodology menu.



2. If the level slider is not already at 1, move the slider to level 1.



Exploring Methodology for C

In this part of the tutorial, you examine **Methodology for C**, which defines the number of orange checks you review in assistant mode.

To examine the configuration for **Methodology for C:**

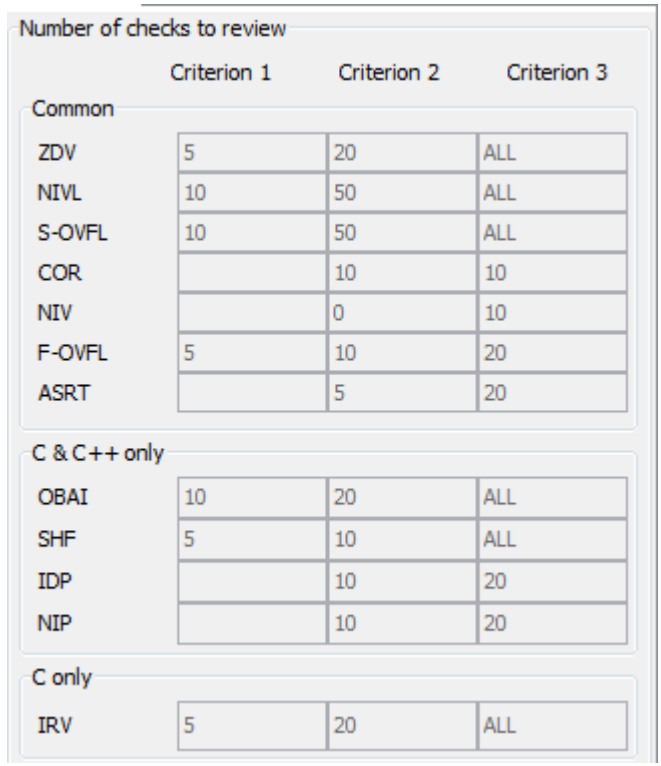
1. Select **Options > Preferences**.

The Polyspace Preferences dialog box opens.

2 Select the **Assistant configuration** tab.

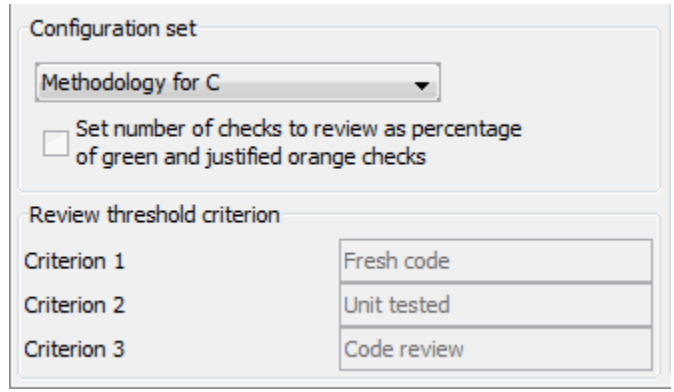
The configuration for Methodology for C opens.

On the right side of the dialog box, a table shows the number of orange checks that you review for a given criterion and check category.



For example, the table specifies that you review five orange ZDV checks when you select criterion 1. The number of checks increases as you move from criterion 1 to criterion 3, reflecting the changing review requirements as you move through the development process.

In the lower-left part of the dialog box, the section **Review threshold criterion** contains text that appears in the tooltip for the criterion slider on the Run-Time Checks toolbar.



For the configuration Methodology for C, the following table lists the criterion names.

Criterion	Name in the Tooltip
1	Fresh code
2	Unit tested
3	Code Review

These names correspond to phases of the development process.

3 Click **OK** to close the dialog box.

Reviewing Checks

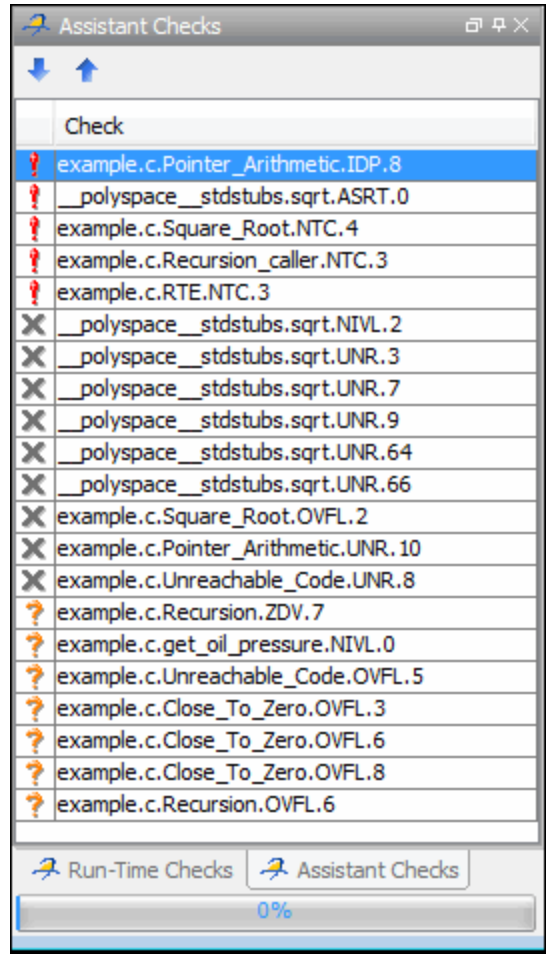
In assistant mode, you review checks in the order in which Polyspace software presents them:

- All of the red checks.
- All blocks of gray checks (the first check in each unreachable function).
- Orange checks according to the selected methodology and criterion level.

Earlier in this tutorial, you selected Methodology for C, criterion l. In this part of the tutorial, you review the checks for `example.c` using this methodology and criterion. To navigate through these checks:

1 Click the forward arrow  .

The Assistant Checks tab shows the current check (`IDP.8`).



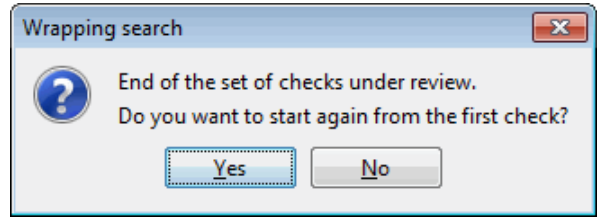
The source code view (lower right) displays the source for this check and the current check view (upper right) displays information about this check.

Note You can display the calling sequence and track review progress, as described in "Reviewing Results in Manual Mode" on page 4-8.

---

2 Continue to click the forward arrow until you have gone through all of the checks.

After the last check, a dialog box opens asking if you want to start again from the first check.



3 Click **No**.

Defining a Custom Methodology

You cannot change the predefined methodologies, such as Methodology for C, but you can define your own methodology. In this part of the tutorial, you learn how to create and use your own methodology.

The methodology that you create is the Methodology for C with one change.

To define your custom methodology:

1 Select **Options > Preferences**.

The Polyspace Preferences dialog box opens.

2 Select the **Assistant configuration** tab.

3 Select **Add a set** from the **Configuration set** menu.

4 In the Create a new set dialog box, enter `My methodology` for the name and click **Enter** to close the dialog box.

5 Under the **Criterion 1** column, enter the number `1` next to **IDP**. Polyspace software selects up to one orange IDP for review.

6 Click **OK** to save the methodology and close the dialog box.

To use `My methodology`:

1 Select `My methodology` from the methodology menu.

2 If the level slider is not already at 1, move the slider to level 1.

3 Click the forward arrow  to review the checks.

With this methodology at criterion 1, you review the orange IDP.17 (you did not review IDP.17 earlier in the tutorial because the number of orange IDP checks in Methodology for C, criterion 1 is zero).

Automatically Testing Unproven Code

Reviewing orange code to find true errors is a time-consuming task. You can use the Automatic Orange Tester (AOT) to automatically create and run test cases to identify errors in the orange code. The workflow for using the AOT is:

1. Set an option to indicate that you want to prepare automatic tests.
2. Run the verification to prepare the tests and verify the source code.
3. When the verification is finished, run the test cases.
4. Review the results.

To learn how to use the AOT, see "Automatically Testing Orange Code" in the *Polyspace Products for C User's Guide*.

Generating Reports of Verification Results

In this section...

Polyspace Report Generator Overview

The Polyspace Report Generator allows you to generate reports about your verification results, using predefined report templates.

The Polyspace Report Generator provides the following report templates:

- **Coding Rules Report** – Provides information about compliance with MISRA C Coding Rules, as well as Polyspace configuration settings for the verification.
- **Developer Report** – Provides information useful to developers, including summary results, detailed lists of red, orange, and gray checks, and Polyspace configuration settings for the verification. Detailed results are sorted by type of check (Proven Run-Time Violations, Proven Unreachable Code Branches, Unreachable Functions, and Unproven Run-Time Checks).
- **Developer Review Report** – Provides the same information as the Developer Report, but reviewed results are sorted by review classification (`High`, `Medium`, `Low`, `Not a defect`) and status, and untagged checks are sorted by file location.
- **Developer with Green Checks Report** – Provides the same content as the Developer Report, but also includes a detailed list of green checks.
- **Quality Report** – Provides information useful to quality engineers, including summary results, statistics about the code, graphs showing distributions of checks per file, and Polyspace configuration settings for the verification.
- **Software Quality Objectives Report** – Provides comprehensive information on software quality objectives (SQO), including code metrics, code analysis (coding-rules checker results), code verification (run-time checks), and the configuration settings for the verification. The code

metrics section provides is the same information displayed in the Polyspace Metrics web interface.

The Polyspace Report Generator allows you to generate verification reports in the following formats:

- HTML
- PDF
- RTF
- Microsoft Word
- XML

Note Microsoft Word format is not available on UNIX platforms. If you select Word format on a UNIX platform, the software uses RTF format instead.

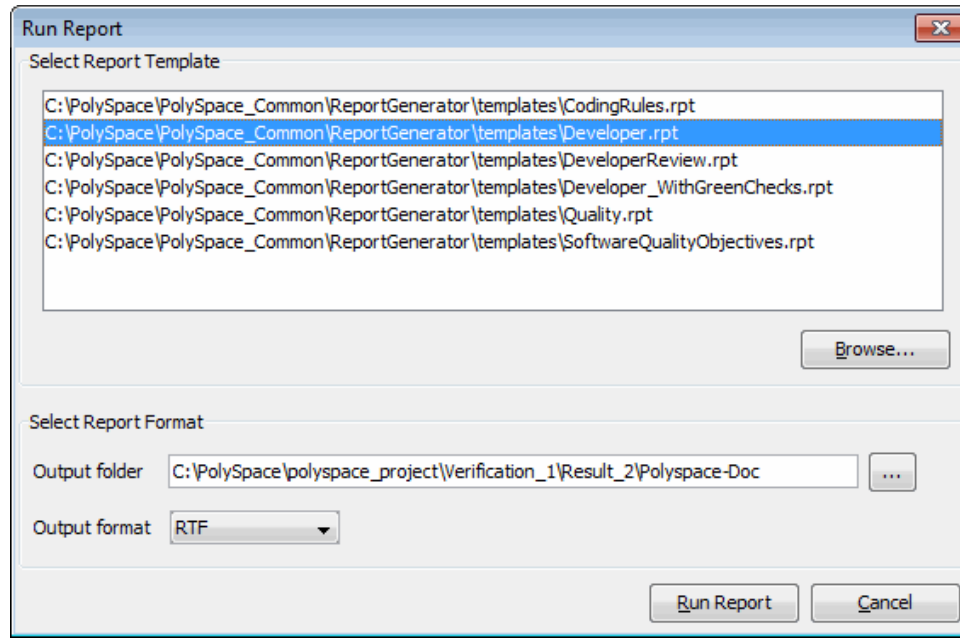
Generating Report for `example.c`

You can generate reports for any verification results using the Polyspace Report Generator.

To generate a verification report:

1. If your verification results are not already open, open them.
2. Select **Run > Run Report > Run Report**.

   The Run Report dialog box opens.



3 In the Select Report Template section, select **Developer.rpt**.

4 In the Output folder section, select the `\polyspace_project` folder.

5 Select PDF Output format.

6 Click **Run Report**.

The software creates the specified report. When report generation is complete, the report opens.

5

Checking MISRA C Compliance

About Checking MISRA C Compliance Tutorial

In this section...

Overview

Polyspace software allows you to analyze code to demonstrate compliance with MISRA C 2004 standards.[3]

Applying coding rules can both reduce the number of orange checks in your verification results, and improve the quality of your code. Coding rules are the most efficient way to reduce orange checks.

To check compliance with coding rules, you set an option in your project and then run a verification. Polyspace software finds the violations during the compile phase of a verification. When you have addressed all coding rule violations, you run the verification again.

In this tutorial, you learn how to:

1. Create a second verification within your project.
2. Set an option for checking MISRA C compliance.
3. Select MISRA C rules to check.
4. Run a verification with MISRA C checking.
5. View coding rules violations using the Coding Rules perspective.

Before You Start

For this tutorial, you check the MISRA C compliance of the file `example.c`, using the project that you created in Chapter 2, "Setting Up a Polyspace Project".

3. MISRA and MISRA C are registered trademarks of MISRA Ltd., held on behalf of the MISRA Consortium.

Setting Up MISRA C Checking

In this section...

Opening Your Example Project

For this tutorial, you modify the project in `example.cfg` to include MISRA C checking. You use the Project Manager perspective to modify the project.

To open `example_project.cfg`:

1. Select **File > Open Project**.

   The Open a Polyspace project file dialog box opens.

2. Navigate to `polyspace_project`.

3. Select `example_project.cfg`.

4. Click **Open** to open the file and close the dialog box.

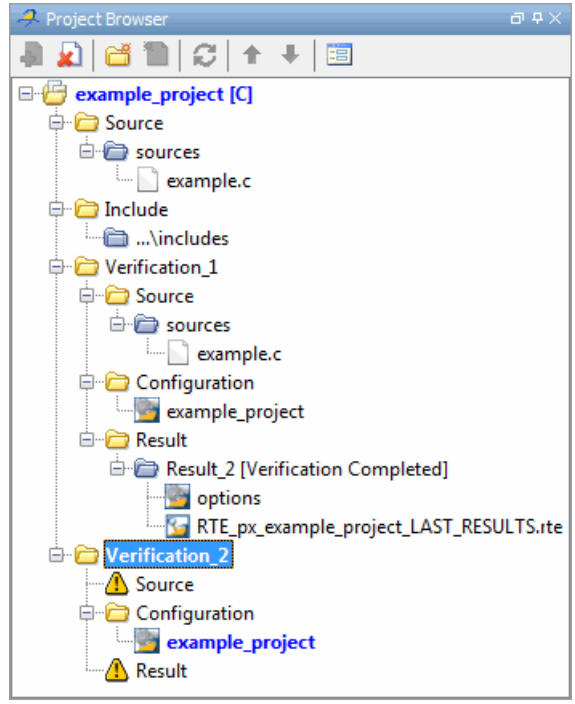
Creating New Verification

A Polyspace project can contain multiple verifications. Each verification may verify a different set of source files, and may use different analysis options. In this section, you create a second verification to check coding rules compliance for the `example.c` file.

To create a new verification in `example_project`:

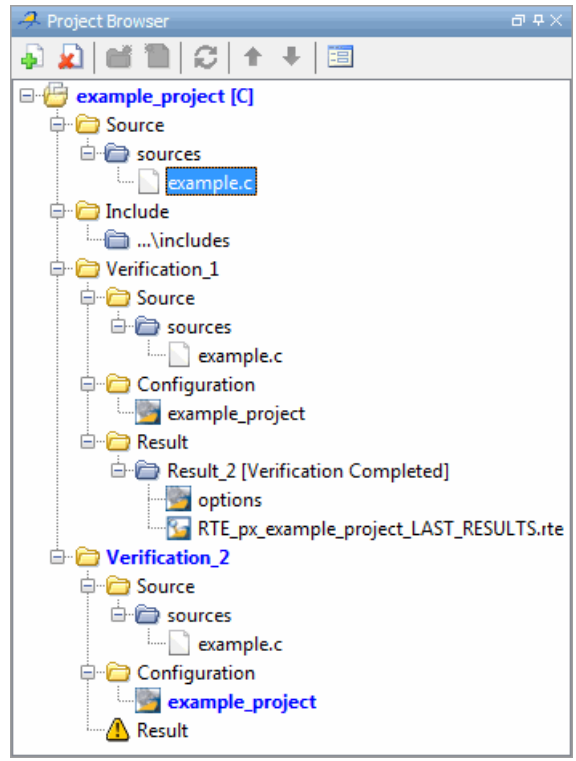
1. In the Project Browser, select **example_project [C]**.
2. Click the **Create a new verification** icon  in the Project Browser toolbar.

   A new verification, `Verification_(2)`, appears in the Project Browser.



3 In the Project Browser Source tree, right-click `example.c`, and select **Copy Source File to > Verification_(2).**

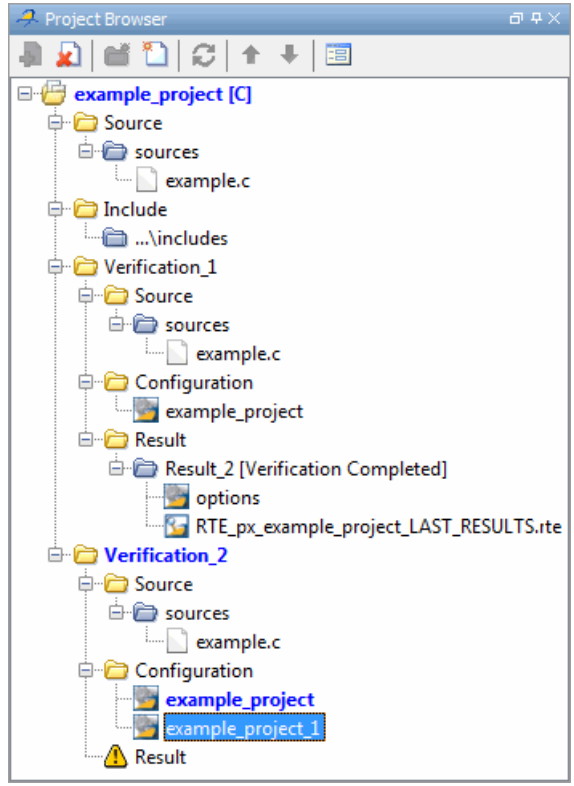
The `example.c` file appears in the Source tree of `Verification_(2)`.



4 Right-click the Configuration folder in Verification_(2), and select **Create New Configuration**.

5 Right-click the `example_project_1` configuration, and select **Set as Active Configuration**.

The Project Browser now looks like the following figure.

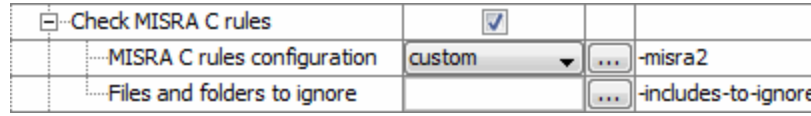

Project Browser
example_project [C]
Source
sources
example.c
Include
...\includes
Verification_1
Source
sources
example.c
Configuration
example_project
Result
Result_2 [Verification Completed]
options
RTE_px_example_project_LAST_RESULTS.rte
Verification_2
Source
sources
example.c
Configuration
example_project
example_project_1
Result

Setting MISRA C Checking Option

You set up MISRA C checking by setting an analysis option and then selecting the rules to check. To set the MISRA C checking option:

1. Select the **`example_project_(1)`** Configuration in the Project Browser.
2. In the Analysis options part of the Configuration pane, expand the **Compliance with standards** option.
3. Select the **Check MISRA C rules** check box.
4. Expand the **Check MISRA C rules** option.

   Two options appear, **MISRA C rules configuration** and **Files and folders to ignore**.



   These options allow you to specify which MISRA C rules to check and which, if any, files to exclude from the code analysis.

5. In the MISRA C rules configuration drop-down list, select **custom**.

Creating a MISRA C Rules File

You must have a rules file to run a verification with MISRA C checking. You can use an existing file or create a new one. You create a new rules file for this tutorial by:

- "Opening a New Rules File" on page 5-8
- "Setting All the Rules to Off" on page 5-9
- "Selecting the Rules to Check" on page 5-9

Opening a New Rules File

To open a new rules file:

1. Click the button  to the right of the **Rules configuration** option.

   A window for opening or creating a MISRA C rules file opens.

2. Select **File > New File**.

   A table of rules appears. For each rule, specify one of the following states.

State	Causes the verification to...
Error	End after the compile phase when this rule is violated.
Warning	Display warning message and continue verification when this rule is violated.
Off	Skip checking of this rule.

Note The default state for most rules is `Warning`. The state for rules that have not yet been implemented is `Off`. Some rules always have a state of `Error` (you cannot change this state).

Setting All the Rules to Off

In this tutorial, you check only a few rules. Therefore, first set the state of all rules to `Off`. Later, you can select the specific rules that you want to check.

To set the state of all rules to `Off`:

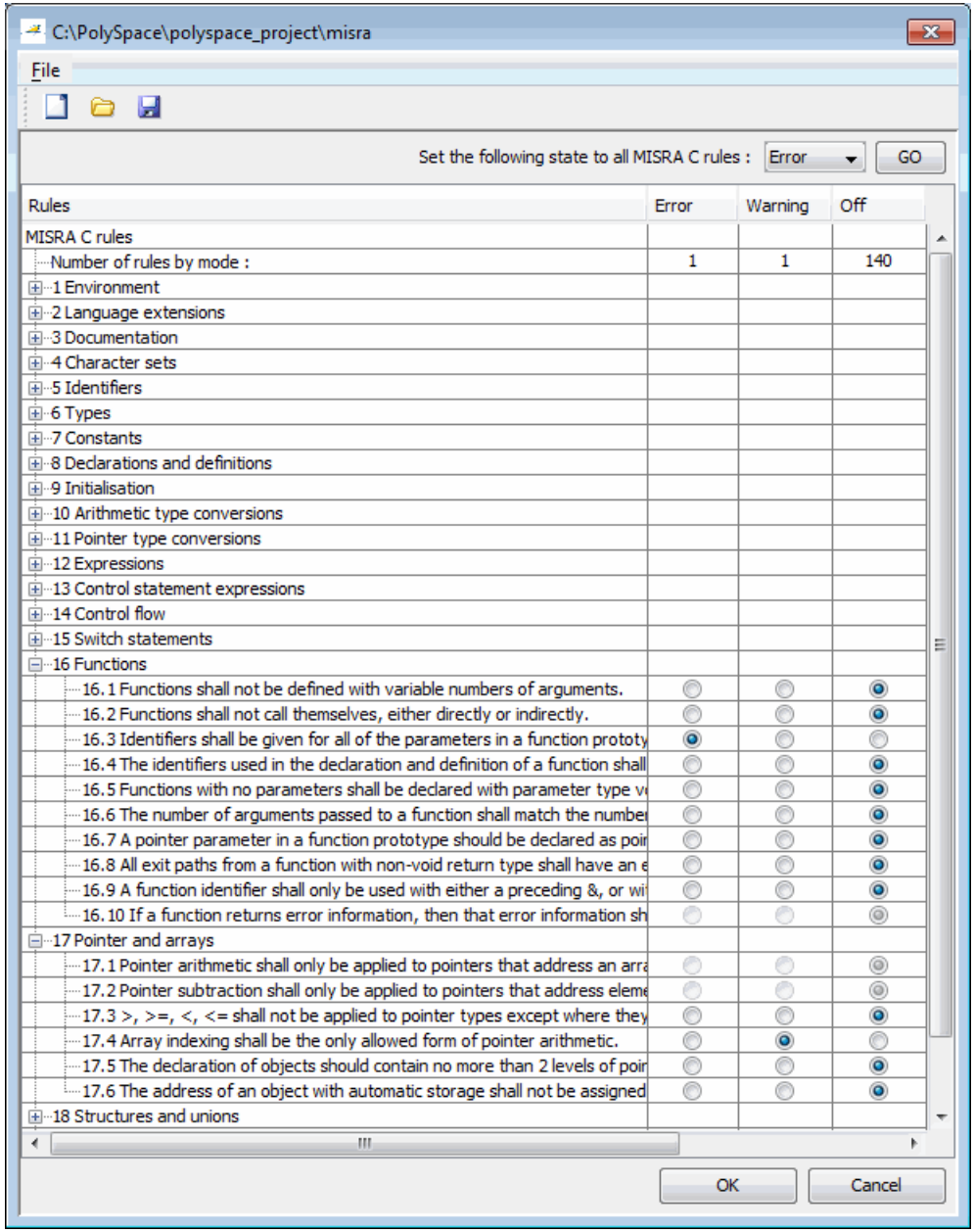
1. From the **Set the following state to all MISRA rules** menu, select **Off** .
2. Click **Go**.

Selecting the Rules to Check

To select the rules to check for this tutorial:

1. Expand the set of rules named `16 Functions`.
2. Select the **Error** column for `16.3`.
3. Expand the set of rules named `17 Pointers and Arrays`.
4. Select the **Warning** column for `17.4`.

   The completed rules table looks like the following figure:


C:\PolySpace\polyspace_project\misra
File
Set the following state to all MISRA C rules :
Error
GO
Rules
Error
Warning
Off
MISRA C rules
Number of rules by mode :
1
1
140
1 Environment
2 Language extensions
3 Documentation
4 Character sets
5 Identifiers
6 Types
7 Constants
8 Declarations and definitions
9 Initialisation
10 Arithmetic type conversions
11 Pointer type conversions
12 Expressions
13 Control statement expressions
14 Control flow
15 Switch statements
16 Functions
16.1 Functions shall not be defined with variable numbers of arguments.
16.2 Functions shall not call themselves, either directly or indirectly.
16.3 Identifiers shall be given for all of the parameters in a function prototy
16.4 The identifiers used in the declaration and definition of a function shall
16.5 Functions with no parameters shall be declared with parameter type v
16.6 The number of arguments passed to a function shall match the numbe
16.7 A pointer parameter in a function prototype should be declared as poi
16.8 All exit paths from a function with non-void return type shall have an e
16.9 A function identifier shall only be used with either a preceding &, or wi
16.10 If a function returns error information, then that error information sh
17 Pointer and arrays
17.1 Pointer arithmetic shall only be applied to pointers that address an arra
17.2 Pointer subtraction shall only be applied to pointers that address eleme
17.3 >, >=, <, <= shall not be applied to pointer types except where they
17.4 Array indexing shall be the only allowed form of pointer arithmetic.
17.5 The declaration of objects should contain no more than 2 levels of poi
17.6 The address of an object with automatic storage shall not be assigned
18 Structures and unions
OK
Cancel

5 Click **OK** to save the rules and close the window.

The Save as dialog box opens.

6 In **File**, enter `misrac.txt`

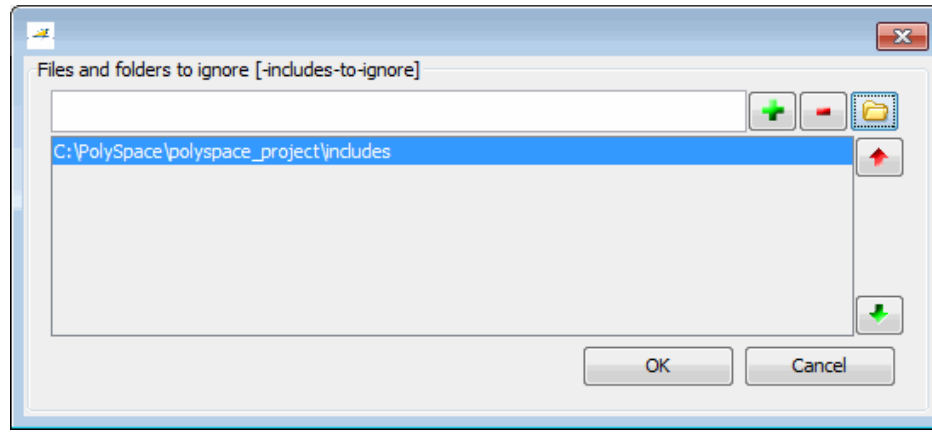
7 Click **OK** to save the file and close the dialog box.

Excluding Files from the MISRA C Checking

You can exclude files from MISRA C checking. You might want to exclude some included files. To exclude `math.h` from the MISRA C checking of the project `example.cfg`:

1 Click the button  to the right of the **Files and folders to ignore** option.

The Files and folders to ignore dialog box opens.



2 Click the folder icon  .

3 Navigate to the folder `polyspace_project\includes`.

4 Select the file `math.h`.

5 Click **OK**.

The file `math.h` appears in the list of files to ignore.

6 Click **OK** to close the dialog box.

Configuring Text and XML Editors

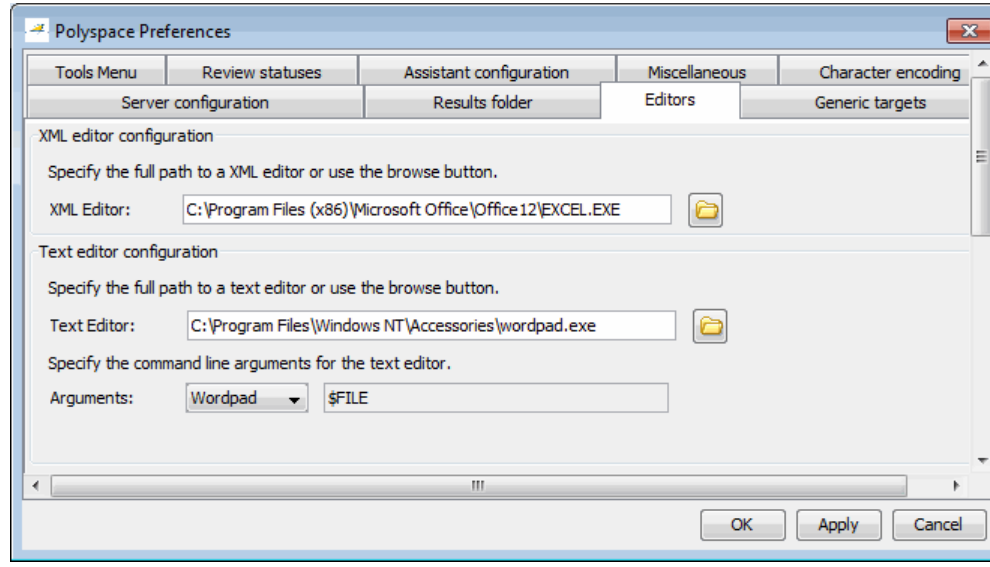
Before you check MISRA® rules, configure your text and XML editors in the Preferences. Configuring text and XML editors allows you to view source files and MISRA reports directly from the Coding Rules perspective.

To configure your text and .XML editors:

1 Select **Options > Preferences**.

The Preferences dialog box opens.

2 Select the **Editors** tab.



3 Specify an XML editor to use to view MISRA-C reports. For example:

```
C:\Program Files\MSOffice\Office12\EXCEL.EXE
```

4. Specify a Text editor to use to view source files from the Project Manager logs. For example:

   ```
   C:\Program Files\Windows NT\Accessories\wordpad.exe
   ```

5. Select your text editor in the Arguments drop-down menu to automatically specify the command line arguments for that editor.

   - `Emacs`
   - `Notepad++`
   - `UltraEdit`
   - `VisualStudio`
   - `Wordpad`

   If you are using another text editor, select `Custom` from the drop-down menu, and specify the command line arguments for the text editor.

6. Click **OK**.

Saving the Project

Save your project to save your new verification and analysis settings.

Running a Verification with MISRA C Checking

In this section...

Starting the Verification

When you run a verification with the MISRA C option selected, the verification checks most of the MISRA C rules during the compile phase.[4]

If there is a violation of a rule with state `Error`, the verification stops.

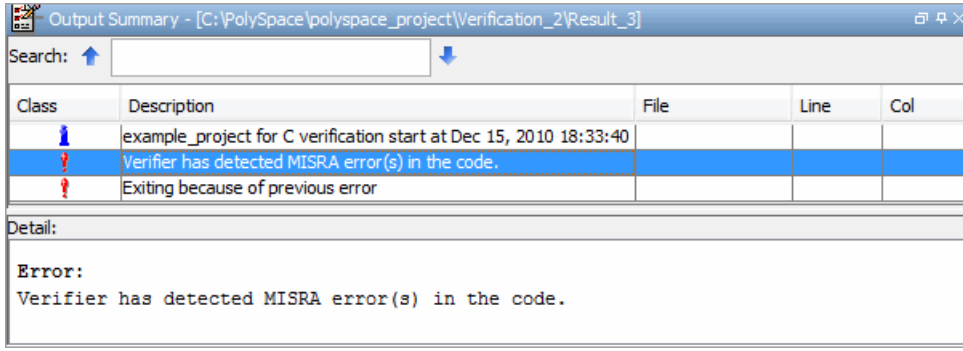
To start the verification:

1. Select **Verification_(2)** in the Project Browser.
2. Click the **Run** button 

on the Project Manager toolbar.

   The verification fails because of MISRA C violations. The message "`Verification Failed`" appears at the bottom of the Project Manager perspective, and the Output Summary indicates that the verification has detected MISRA errors.

4. MISRA and MISRA C are registered trademarks of MISRA Ltd., held on behalf of the MISRA Consortium.

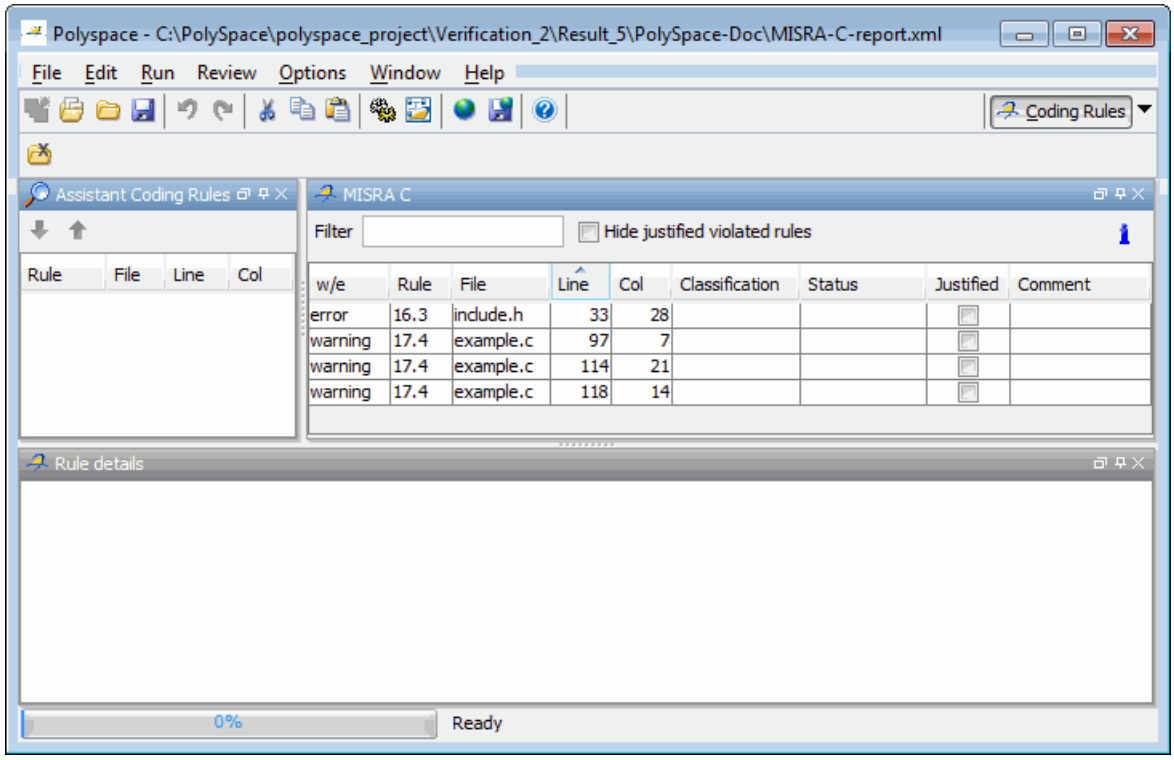

Output Summary - [C:\PolySpace\polyspace_project\Verification_2\Result_3]
Search:
Class
Description
File
Line
Col
example_project for C verification start at Dec 15, 2010 18:33:40
Verifier has detected MISRA error(s) in the code.
Exiting because of previous error
Detail:
Error:
Verifier has detected MISRA error(s) in the code.

Examining MISRA C Violations

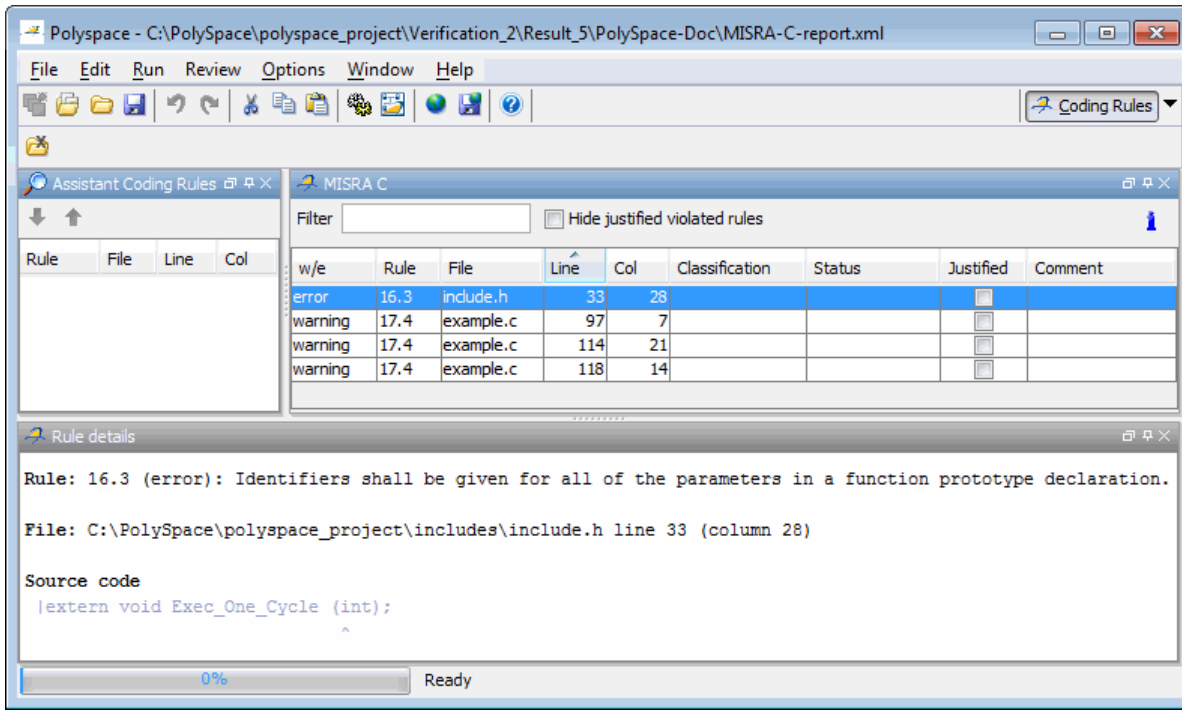
To examine the MISRA C violations:

1 Double-click **MISRA-C-report.xml** in the Project Browser Result folder.

The Coding Rules perspective appears, displaying a list of MISRA C violations.

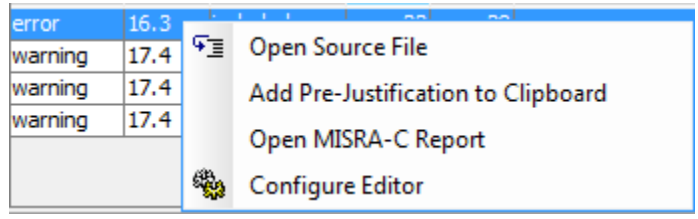


2 Click any of the violations to see a description of the violated rule, the full path of the file in which the violation was found, and the source code containing the violation.



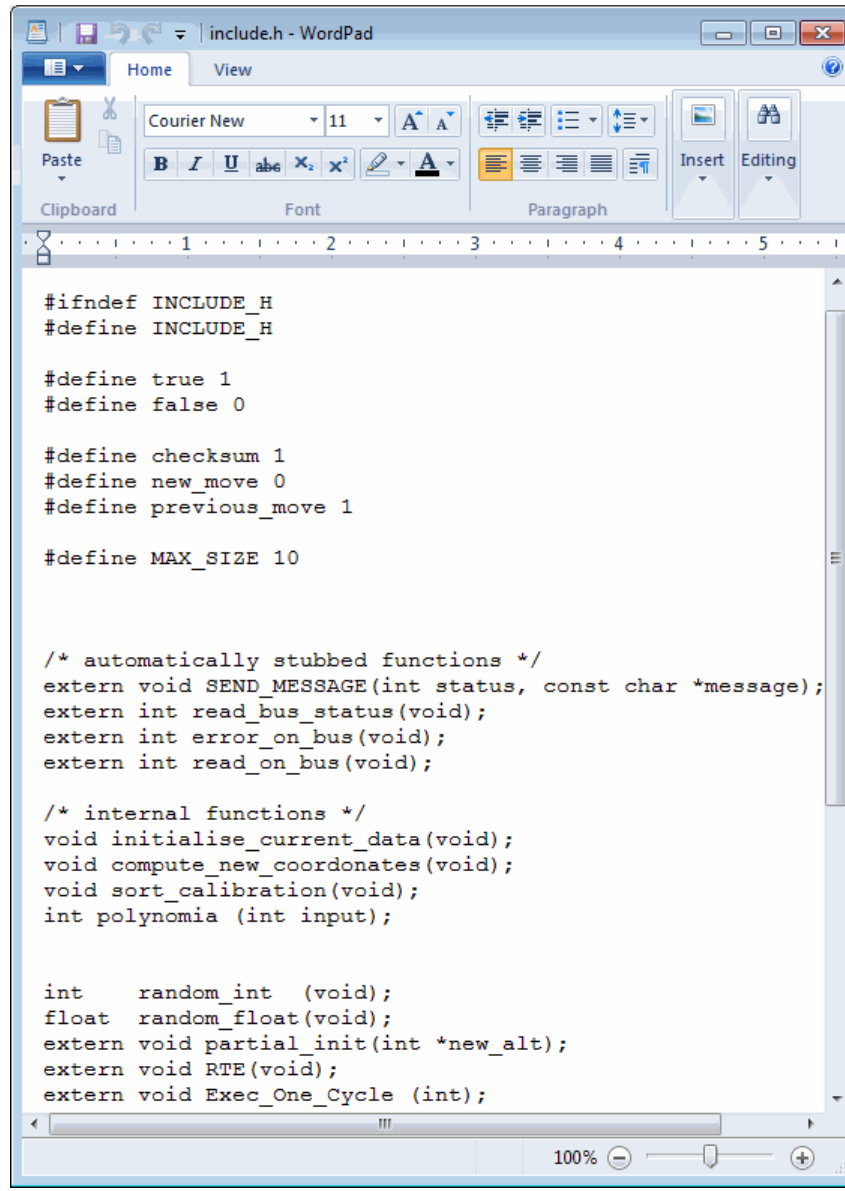
The log reports a violation of rule 16.3. A function prototype declaration in `include.h` is missing an identifier.

3 Right-click the row containing the violation of rule 16.3, and select **Open Source File**.



The `include.h` file opens in your text editor.

Note Before you can open source files, you must configure a text editor. See "Configuring Text and XML Editors" on page 5-12.



4 Correct the MISRA violation and run the verification again.

The verification then is completed, and the results will be the same as those from the tutorial in Chapter 3, “Running a Verification”.

Opening MISRA-C Report

After you check MISRA rules, you can generate an XML report containing all the errors and warnings reported by the MISRA-C checker.

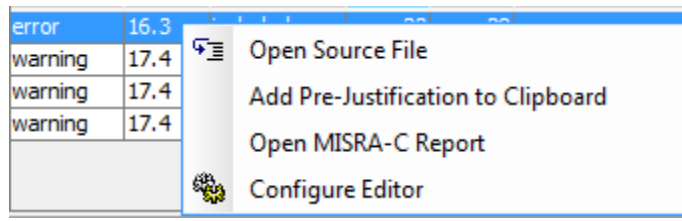
Note Before you can open a MISRA-C report, you must configure an XML editor. See “Configuring Text and XML Editors” on page 5-12.

To view the MISRA-C report:

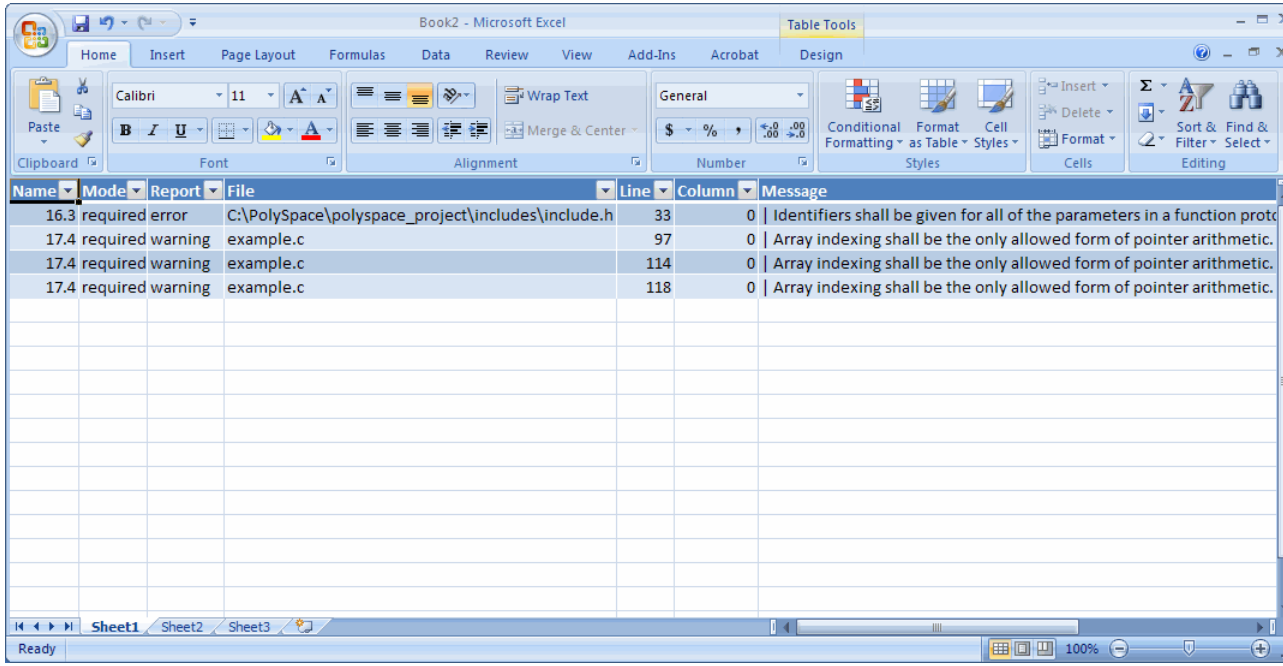
1. Click the **Coding Rules** button in the Polyspace Verification Environment toolbar.

   A list of MISRA C violations appears in the Coding Rules perspective.

2. Right-click any row in the log, and select **Open MISRA-C Report**.



   The report opens in your XML editor.


Book2 - Microsoft Excel
Table Tools
Home
Insert
Page Layout
Formulas
Data
Review
View
Add-Ins
Acrobat
Design
Paste
Clipboard
Calibri
11
Font
Wrap Text
Merge & Center
Alignment
General
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Insert
Delete
Format
Cells
Sort & Filter
Find & Select
Editing
Name
Mode
Report
File
Line
Column
Message
16.3 required error C:\PolySpace\polyspace_project\includes\include.h 33 0 | Identifiers shall be given for all of the parameters in a function prot
17.4 required warning example.c 97 0 | Array indexing shall be the only allowed form of pointer arithmetic.
17.4 required warning example.c 114 0 | Array indexing shall be the only allowed form of pointer arithmetic.
17.4 required warning example.c 118 0 | Array indexing shall be the only allowed form of pointer arithmetic.
Sheet1
Sheet2
Sheet3
Ready
100%

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