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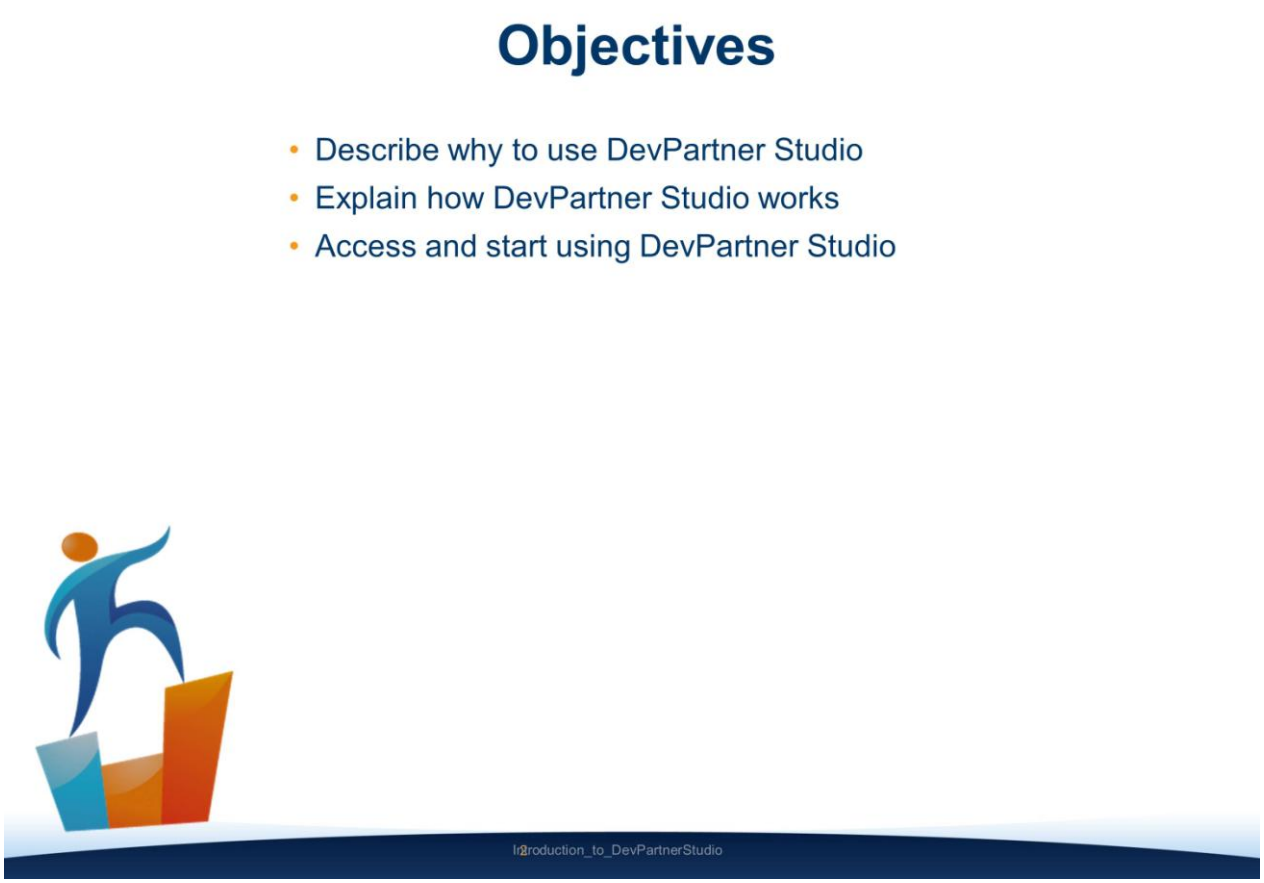
DETAILED GUIDE

DevPartner Studio

Introduction to DevPartner Studio

Micro Focus Education Services
The Lawn
22-30 Old Bath Rd
Newbury
Berkshire
RG 14 1QN

Introduction to DevPartner Studio



This module of the course is intended to provide an overview of DevPartner Studio. This overview includes a discussion of the benefits of using DevPartner Studio, a brief overview of DevPartner Studio to show how the product works, and instructions on how to access DevPartner Studio.

What is DevPartner Studio?

- A virtual expert that automatically detects and diagnoses software defects, performance problems, and security vulnerabilities in your application code.
- Performs static and runtime analysis to find issues before your programs are deployed.
- Set of tools that extend the Microsoft Development and Debugging environment

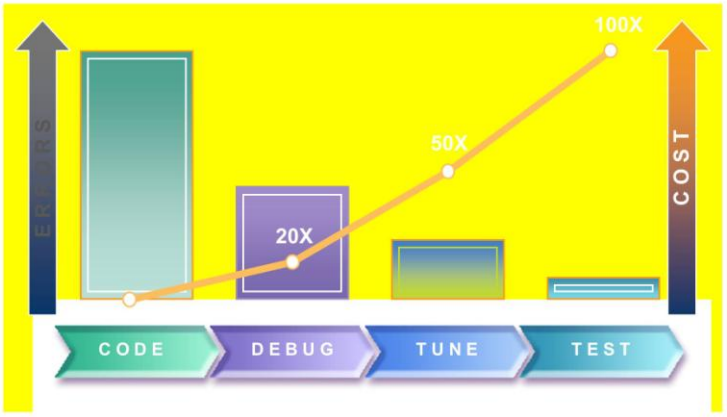
DevPartner Studio is a set of tools designed to find defects and performance issues in your source code. DevPartner uses both static and runtime analysis to help find the issues in your program before deployment. These tools extend the Microsoft Debugging environment.

Cost of Debugging: Money

- How much more expensive is it to fix a defect (bug) later in the life cycle?

Very expensive!!

It can cost up to 100x more to find and fix a bug during testing than during the coding phase.

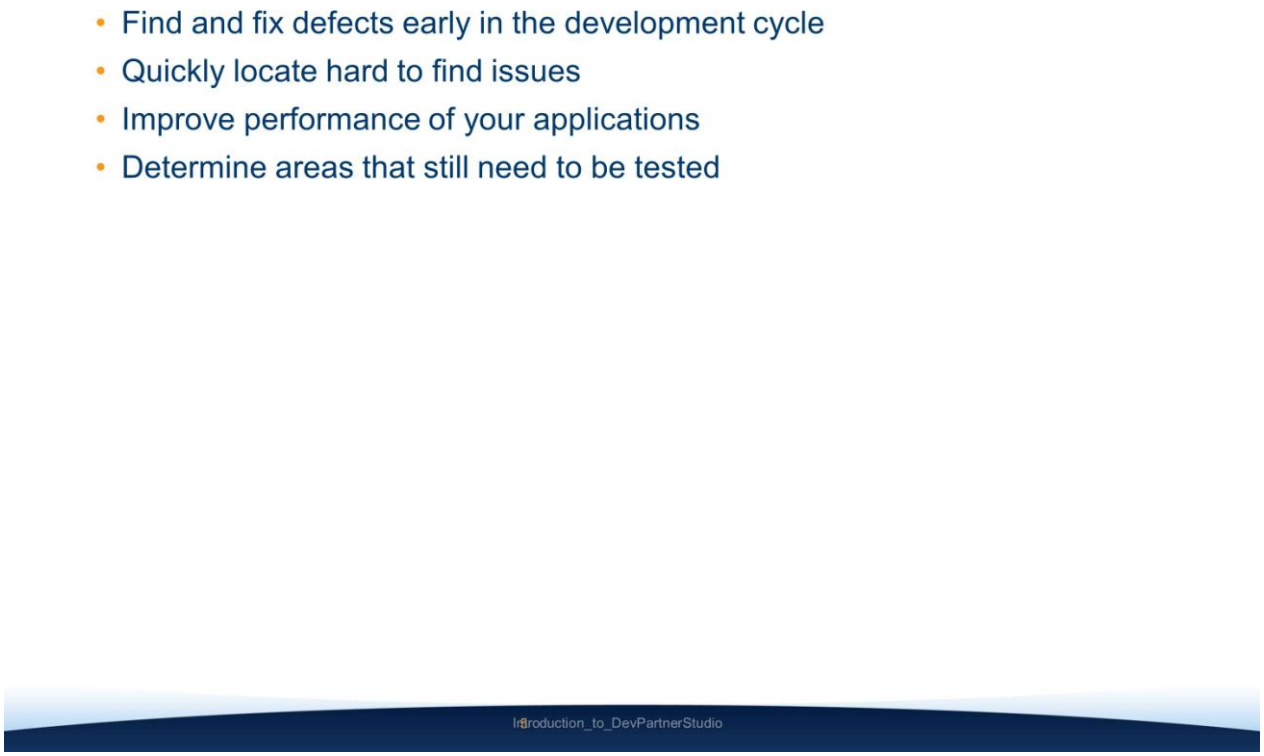


Introduction_to_DevPartnerStudio

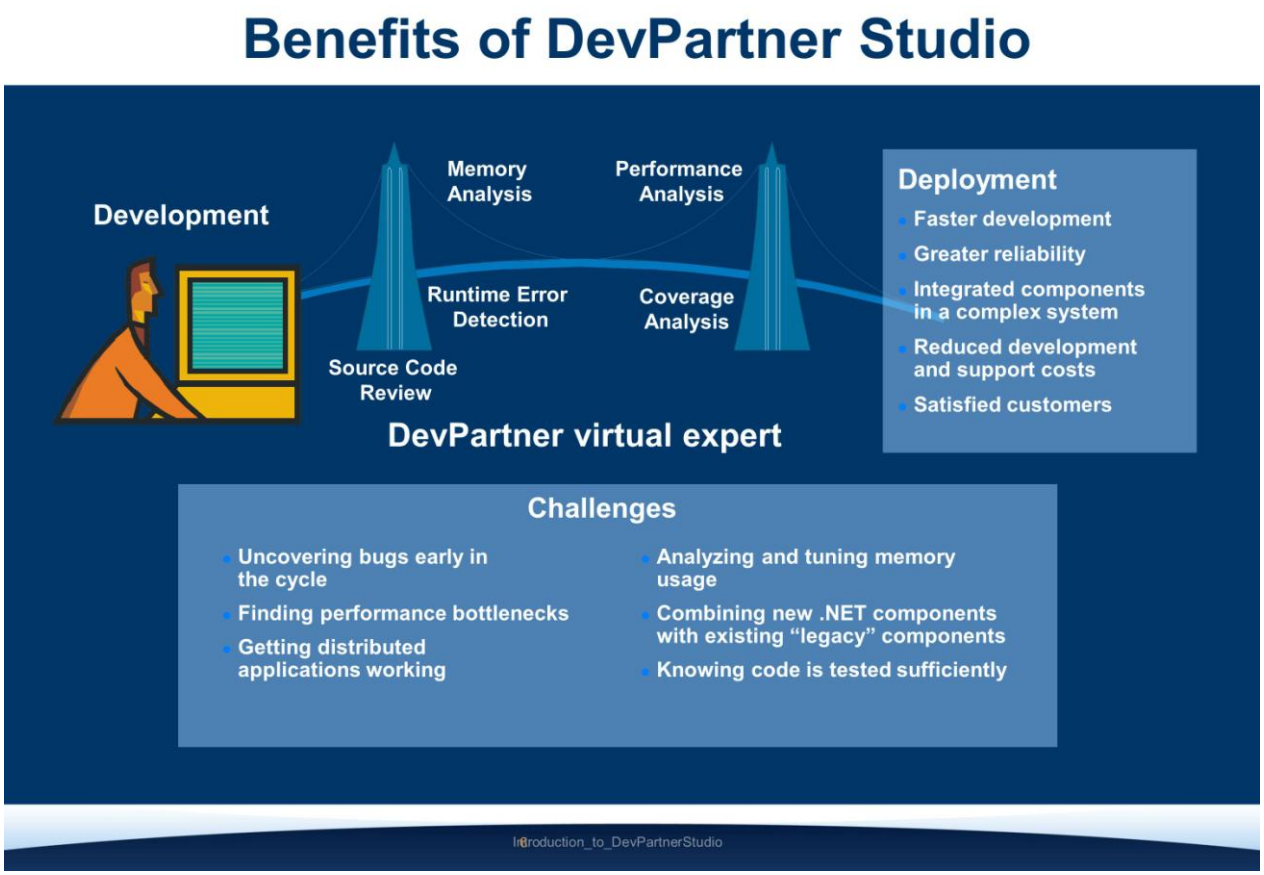
One of the values of DevPartner Studio is the ability to lower the cost to locate and correct problems in software.

It is well known in the industry that the earlier you correct problems, the less expensive it is to make those corrections. Study's have shown that as the project proceeds to completion and the product moves into production use by customers, the cost for repairing problems grows dramatically.

The largest impact you can have on cost is to implement a process that ensures that you find and correct problems in your application as early in the development process as possible.



DevPartner Studio allows you to save time and money by finding hard to find issues quickly, and locating those problems early in the development lifecycle. You can improve the performance of your application by finding and fixing performance bottlenecks and memory issues. You can also see the areas of your application that have been tested, allowing you to see where new tests may need to be conducted.



The Debugging Gap refers to the span of time between writing new code and getting it to work and perform properly. Locating as many problems (bugs) as possible and getting the software to run at the desired speed is usually challenging, even to the most seasoned developers.

Bridging the Debugging Gap

Developers are faced with limited staff trying to meet short deadlines while producing highly reliable results. They make use of complex technologies to create collections of components that must flawlessly work together. Management is concerned with meeting schedules and budgets, and producing a result that has minimal support costs. Sitting between development and new product releases are challenges:

- Bugs are coded in yet not found until testing, pre-production or in production. How do you find bugs?
- How do you find performance bottlenecks?
- How do you locate errors across a complex, distributed, multi-tier environment?
- How do you deal with getting components that are a combination of programming languages working?
- What are you doing to keep your developers current with new languages and coding practices?

DevPartner Studio Professional Edition provides a set of capabilities that developers need to reduce the cost of getting applications into a release stage. The goal is to minimizing errors found later in the application lifecycle and help developers cross the "debugging gap". In effect, DevPartner Studio provides a "Virtual Expert" looking over the shoulder of your developers.

What Technologies does DevPartner Studio support?

- DevPartner Studio supports the following Microsoft Technologies
  - VB
  - C/C++
  - ASP/IIS
  - JScript, JavaScript, VB Script
  - C#, VB.NET, ASP.NET
  - COM, DCOM, COM+, Web Services

DevPartner Studio is comprised of different components, each designed to find specific types of issues in your code.

Source code review- automates the manual code review process, including coding practices and standards. This helps to automatically locate errors earlier in the development process, save time & money.

Performance Profiling– determine how long it takes your application to execute, right down to the line of code, and quickly identify "hot spots" that you can focus on to tune for improved performance. This includes two different types of analysis, Performance Analysis and Performance Expert. This lets you quickly identify where to focus your efforts in order to improve performance.

Memory analysis –shows the amount of memory consumed by the application, and where in the application memory is being used. With an accurate profile of a program's memory usage, developers can improve the runtime performance and resource utilization of their code by optimizing code that consumes or wastes memory. The memory profiler saves valuable development time by helping developers quickly locate inefficient code that would otherwise take hours or days to find manually.

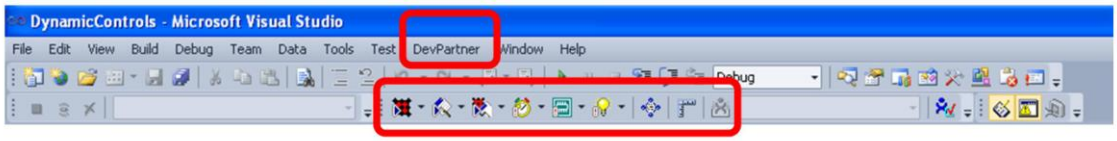
Runtime error detection- automatically detects errors in your C++ code at runtime and notifies the user, rather than relying on the expertise of the developer or the breadth of the Quality Assurance testing to identify errors. This will automatically locate errors earlier in the development process, save time & money.

Coverage analysis –determine overall code coverage levels, locate logic never exercised to assess the risk associated with moving into production. You can immediately measure how complete your testing is, and identify code that has not yet been tested.

System information–determine differences in either two different systems or one system at two different times. This will let you quickly see the differences, to help determine why the application works on one machine but not another, or why the application was working yesterday on my machine, but not today.

Reports – create reports based on results from the different analysis types. These reports allow you to view data outside of the Visual Studio IDE.

Accessing DevPartner Studio



Module Exercise

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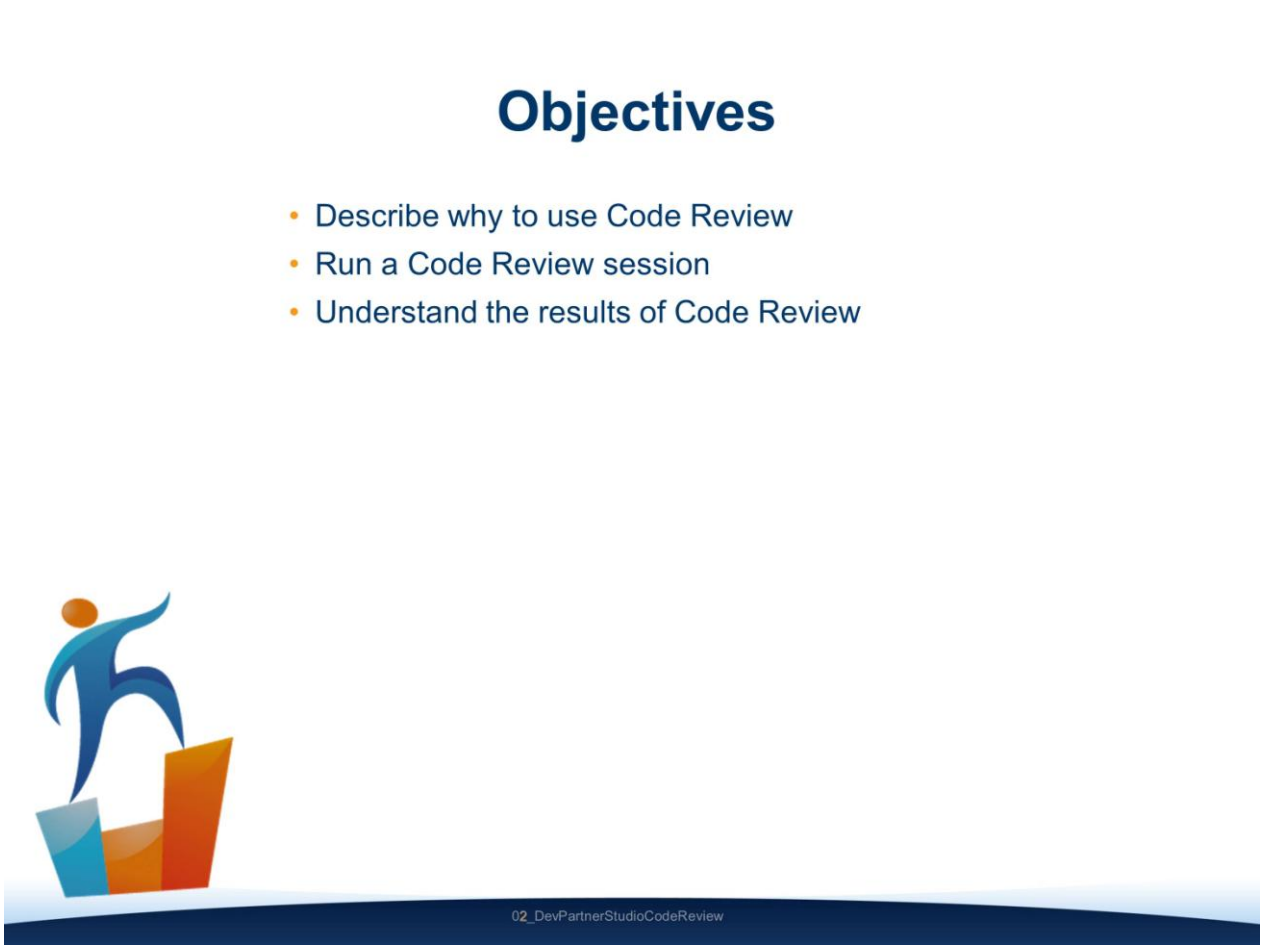
IntroductiontoDevPartnerStudio-EG: Exercise 1

DevPartner Studio Code Review



This module of the course is intended to provide an overview of the Code Review component of DevPartner Studio. This overview includes a discussion of why to use Code Review, how to run Code Review against an application and how to examine the results of a Code Review session.

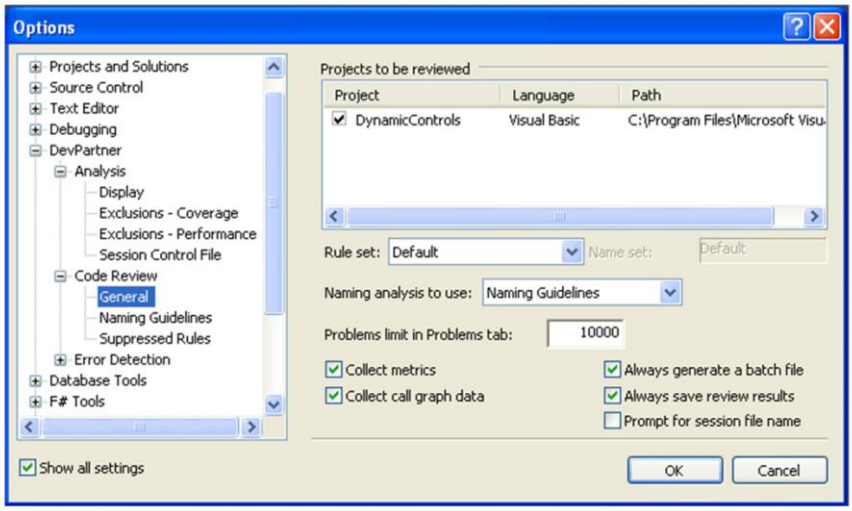
What is Code Review?

- Scans .NET and ASP.NET source code to find hundreds of common problems and suggest best practices, tips and techniques.
- Helps to enforce naming standards.
- Calculates quality metrics for your application code.
- Creates a static call graph to show the relationship between methods in your application code.

Code Review is a component of the DevPartner Studio suite of tools designed to perform static analysis of your application code. Code Review will scan your source code and compare it to a set of rules and naming standards that are defined. Code Review provides many rules out of the box, and you can customize or add additional rules. The Rule Manager is covered in another module of this course.

Code Review will also gather metrics on your source code and create a static call graph to show the relationships between methods in your application.

Code Review Options



02_DevPartnerStudioCodeReview

Code Review scans your source code and checks it against a set of rules. Before you run Code Review, you will want to define the options for the session. You can access the options by choosing the DevPartner->Options menu item inside Visual Studio.

The general tab contains options such as:

Projects to be reviewed: This will contain the list of projects inside the solution you have open inside Visual Studio.

Rule set: a set of rules to be used in the scan. These can be either user created or supplied by DevPartner Studio. Creating and editing rule sets will be covered in the module that covers the Rule Manager.

Naming analysis to use: choose the type of naming analysis to be performed during the review. You can choose Naming Guidelines, which is the default and is patterned after the Visual Studio .NET Framework naming guidelines. You can also choose Hungarian, which is patterned after the Hungarian Notation naming convention. If you choose Hungarian, you also need to select the naming set, which is a set of naming conventions that can be customized. Customization details are covered in the module covering the Code Review Rule Manager. You can also choose none, which will bypass naming analysis.

Problems limit in Problems tab: this field represents the maximum number of problems to list in the Problems tab in your Code Review results. This can be useful to streamline code review processing.

Collect metrics: choose whether you want to analyze code complexity for your application.

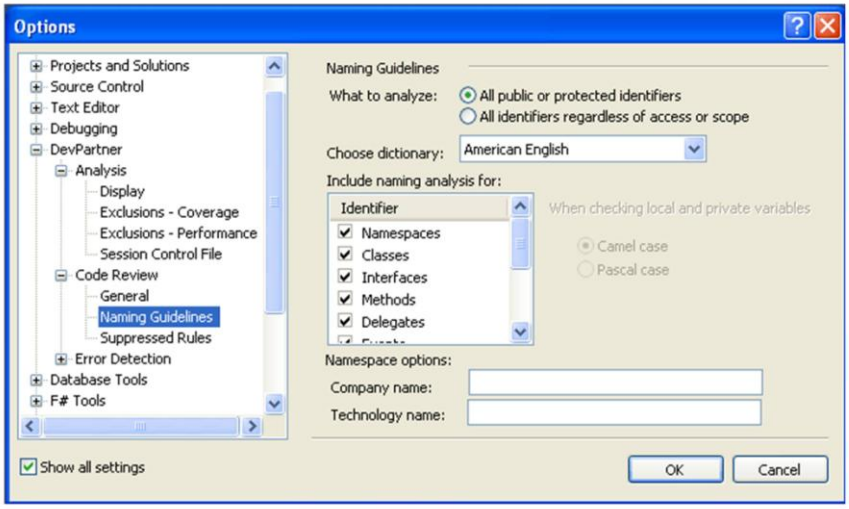
Collect call graph data: choose whether to collect call graph information for your application code. This requires a clean build, free of any compile errors.

Always generate a batch file: will generate a batch file to be used for command line execution of a Code Review.

Always save review results: will save code review session file information. If this is unchecked, DevPartner will only create a temporary file that will be deleted when you close the solution or exit the IDE.

Prompt for session file name: lets you choose to provide your own names for session files being saved.

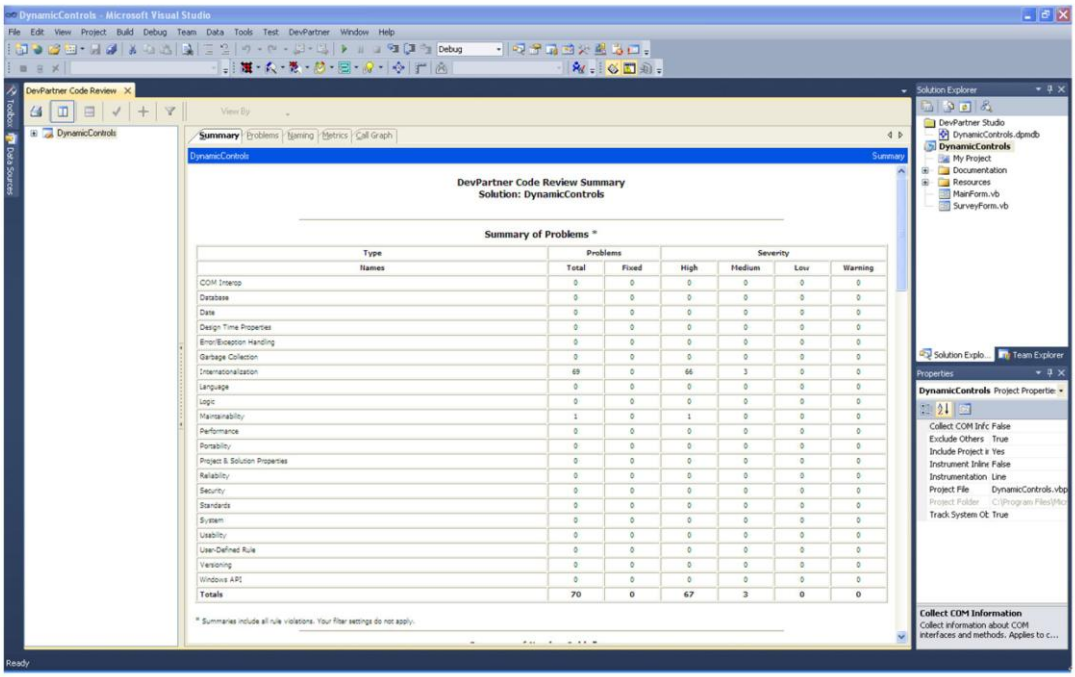
Code Review Options



The Naming Guidelines option section allows for you to ensure a more precise review of your naming standards when using the Naming Guidelines option. These options are only available to be edited when using the Naming Guidelines option in the General Options area.

Once you've defined all the options you need for your Code Review, you can run a scan of your source code by selecting the DevPartner->Perform Code Review menu item, or clicking on the Perform Code Review button in the toolbar.

Code Review

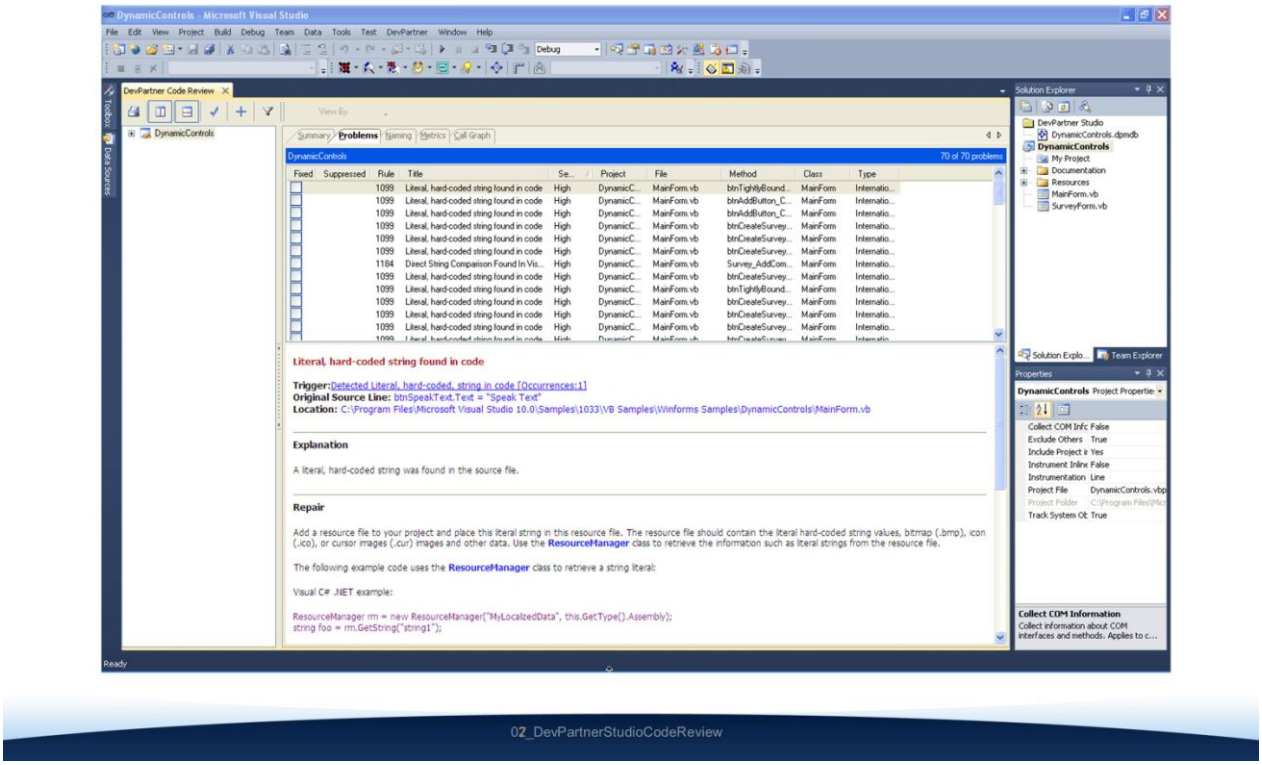


02_DevPartnerStudioCodeReview

Code Review scans your source code for any violations of the rules that you have chosen to include in the options. Once the scan is complete, you'll be presented with the results in a session file. These results have tabs that will contain different data about the scan that just occurred.

The first tab is the summary tab. This gives you an overview on the problems that were found. You can quickly see the types or categories of issues that were found, and a break down by severity. If you scroll down, you will also see the settings for the different Code Review options that were set for this scan.

Code Review



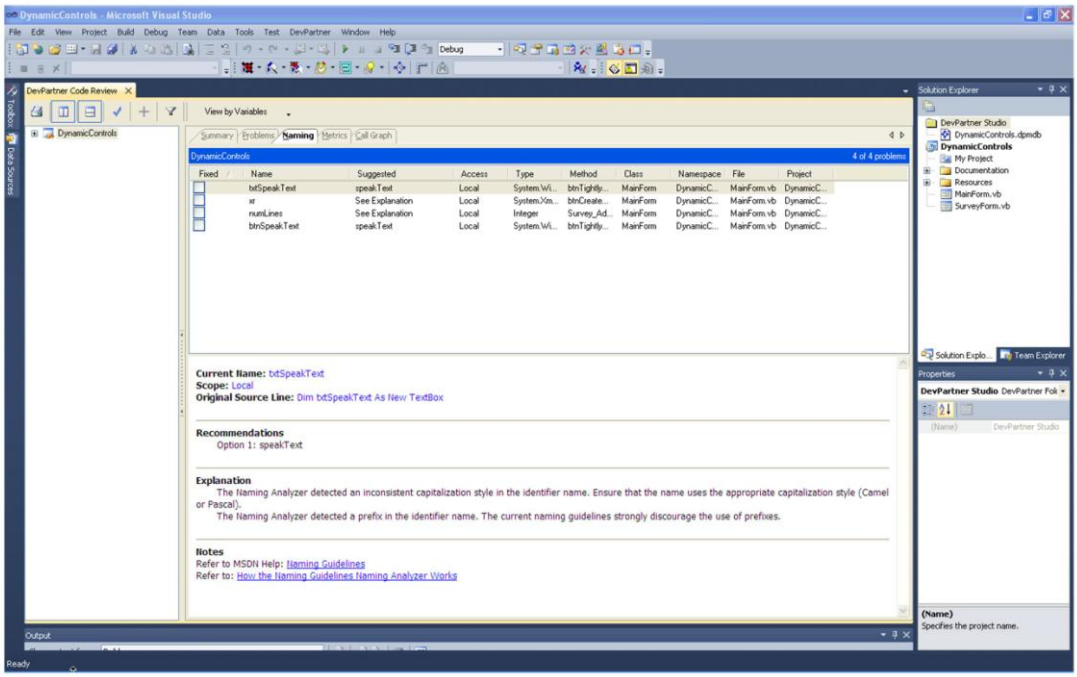
02_DevPartnerStudioCodeReview

The problems tab is where you will see every rule violation that was found during the Code Review. In the top of this window is a list of rules containing the rule number and title, severity, and details on where the violation was inside your source code. Double clicking on a problem will take you to the source code where this issue exists. You can sort by any of these fields by clicking on the column header. Each problem also has a checkbox with the heading fixed. Once you've made repairs to your code, you can use this checkbox. Marking an item as fixed allows you to filter out those items that have been corrected, so you can focus on the remaining problems.

There are different ways to filter the problems that appear in this tab. You can click the filter button which will open the Filter Dialog. In this dialog, you can filter based on type, severity, and whether the problem is marked as fixed or suppressed. Suppressed rules are temporarily deactivated, and can be reactivated inside the Code Review options. Another way to filter is by choosing a specific area of your application on the left hand side of the Code Review results. If you select a file, the only problems that will appear in the list are those that relate to the selected file.

When you select a problem in the top pane, the related description will appear in the lower pane. This will include information about why the rule was fired and the location of the code that flagged the problem. You will also be presented with a lot of information to help you fix the selected problem. This includes an explanation of why this goes against coding standards or could cause a problem in your application, repair recommendations that may contain sample code, and additional notes that may contain links to additional information on the internet, including MSDN articles or Microsoft Knowledge Base articles.

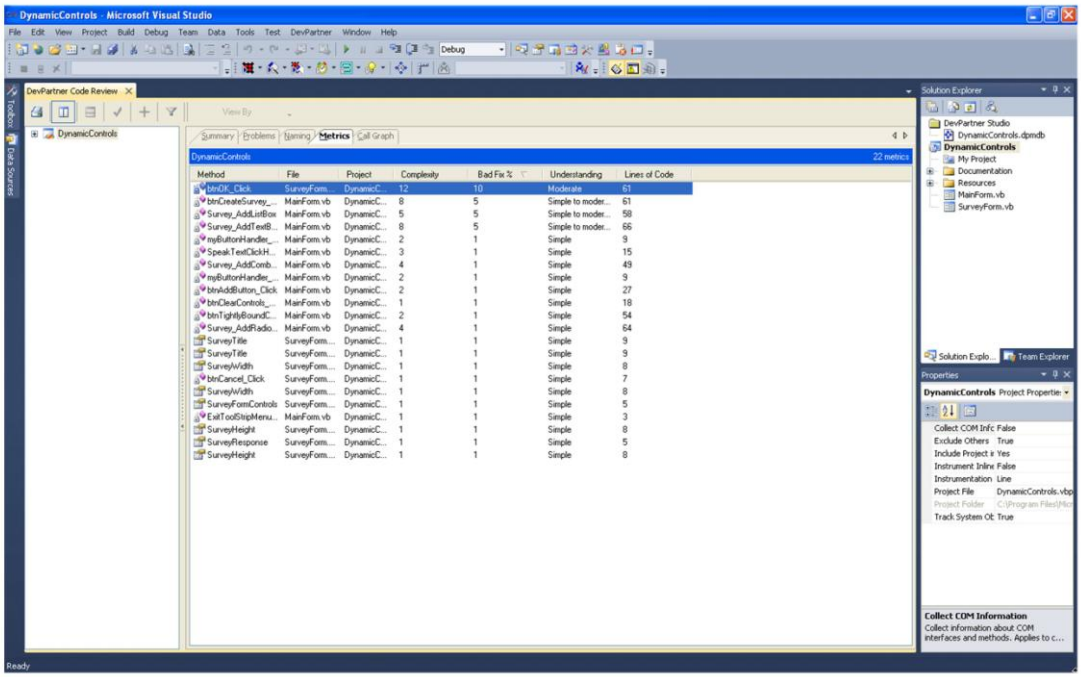
Code Review



The naming tab will show you all the naming violations that were found during the scan. Filtering and sorting work similar to the problems tab. You can sort by clicking on a column header. You can filter by whether a naming violation is fixed or not fixed, and selecting files in the left panel will only display naming issues that pertain to that file.

When you select a naming violation, you will be able to view details such as where the violation was found, recommendations based on the selected naming standards, an explanation of this violation, and links to naming details.

Code Review



The data on the metrics tab is available if you enable metrics collection in the DevPartner options. This lets you view information about your application code, including:

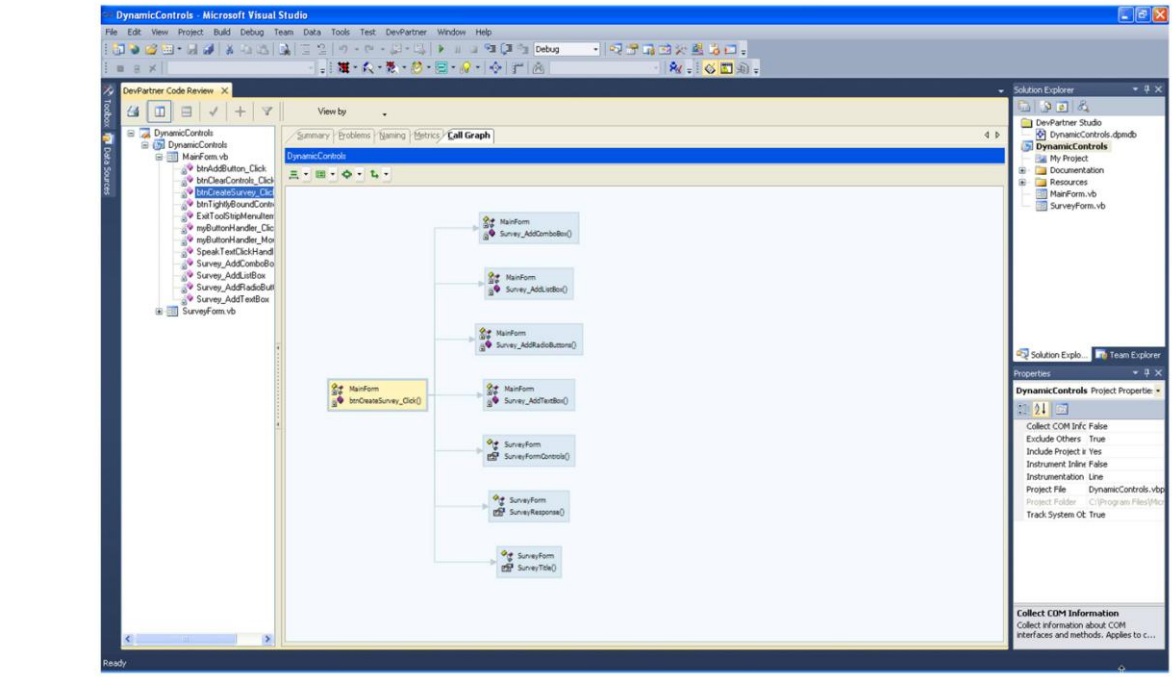
Complexity: which displays the cyclomatic complexity (an industry standard established as part of McCabe Metrics) which measures the degree of complexity in a module's decision structures. It represents the number of linearly independent paths, or the minimum number of paths that should be tested.

Bad Fix %: the probability of inserting a new bug while trying to fix a known one. This correlates to the complexity and understanding level in the metrics and is derived from McCabe Metrics.

Understanding: how easily a developer can interpret and maintain the code.

Lines of Code: the number of lines of code in that area of your application.

Code Review



The call graph tab will show you a graphical representation of the inbound and outbound calls for a method or property that you select from the DevPartner solution tree on the left hand side.

Module Exercise

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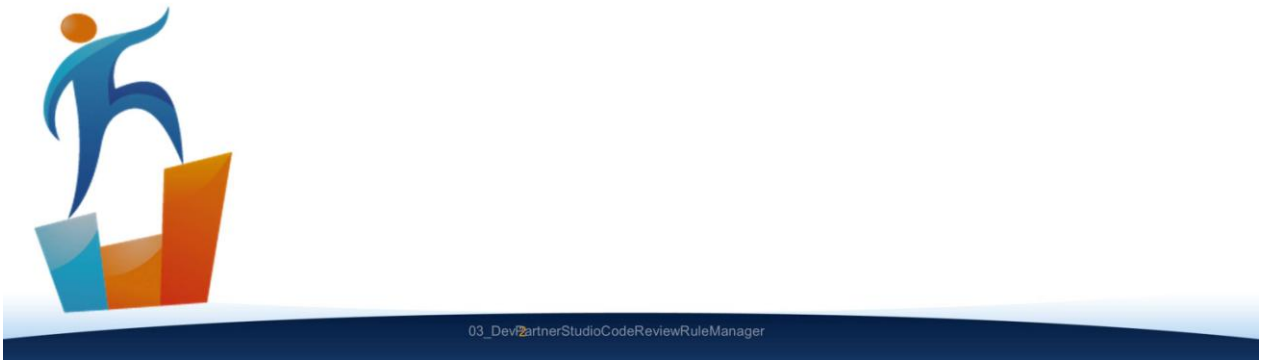
02_DevPartnerStudioCodeReview-EG: Exercise 1

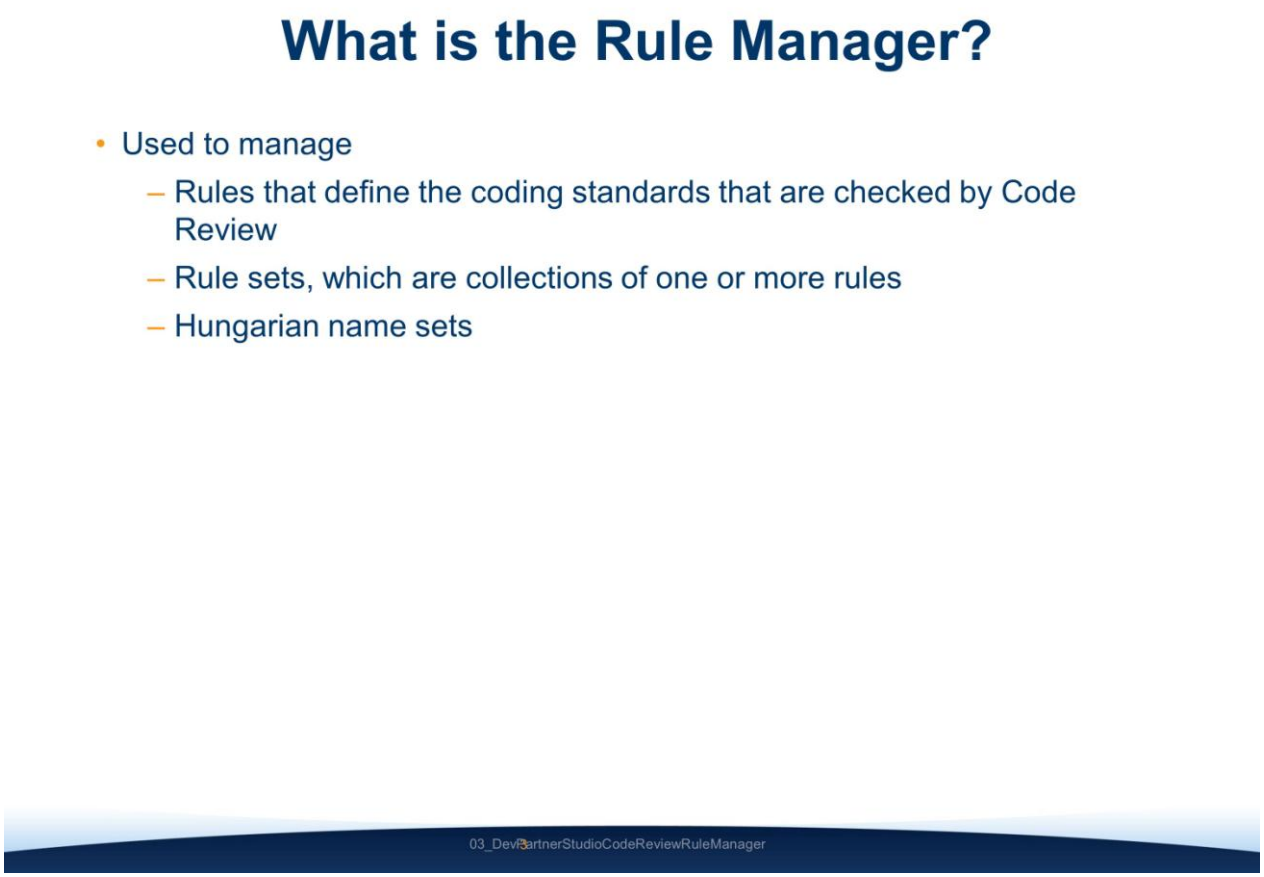
Code Review Rule Manager

Objectives

- Create new Rules for Code Review
- Create new rule sets
- Edit naming conventions

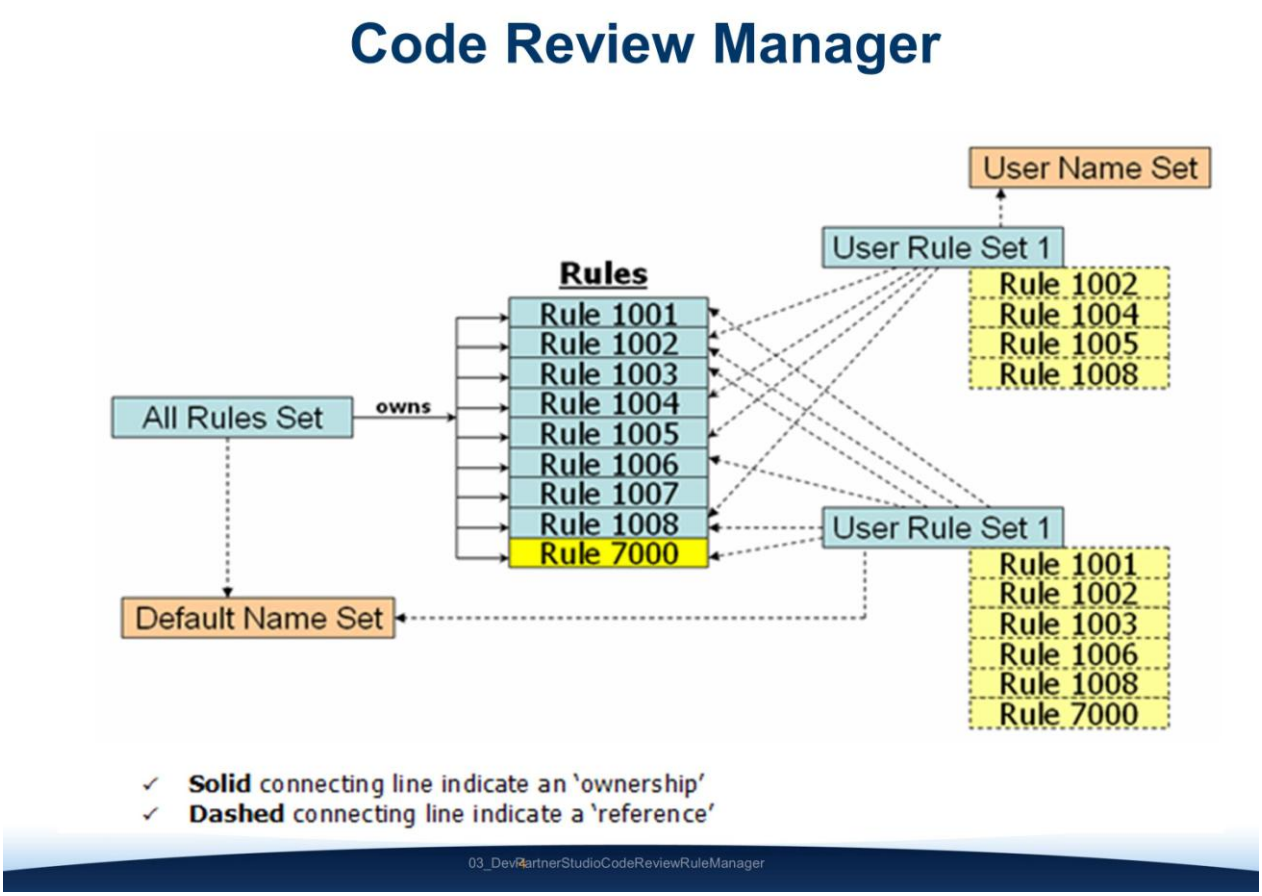


This module of the course is intended to provide an overview of the Code Review Rule Manager. By the end of this module, you should be able to create new rules, create new rule sets and edit naming conventions that are used during a Code Review.



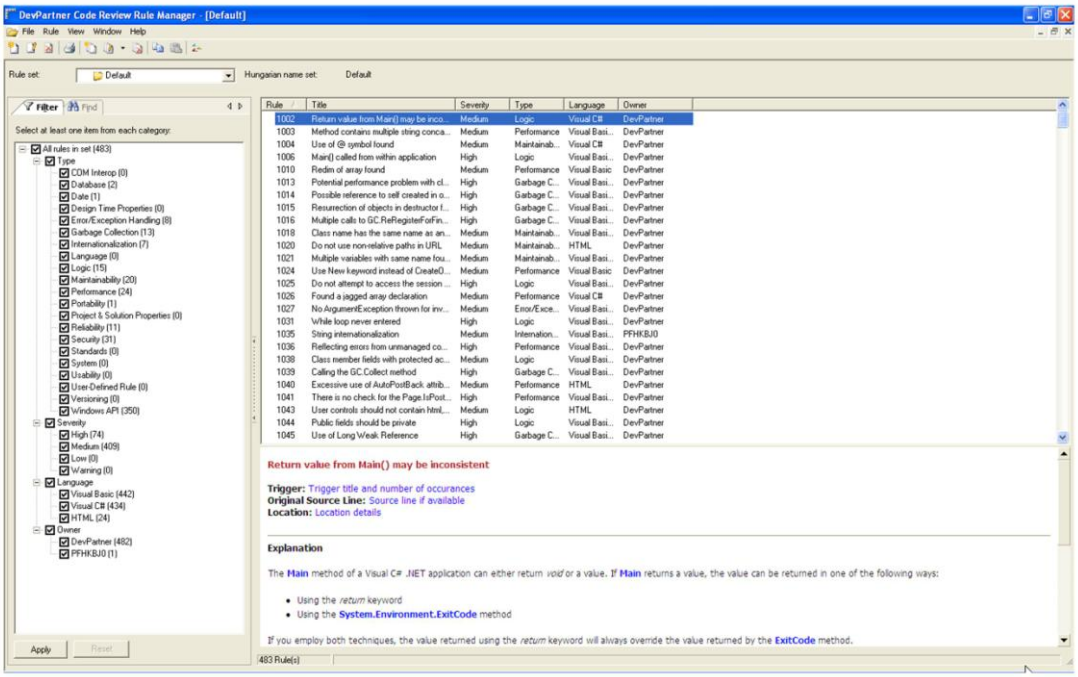
The Code Review Rule Manager allows you to manage the rules being used by Code Review. There are hundreds of rules provided out of the box, and using the Rule Manager you are able to create your own customized rules, edit the naming conventions used, and create rule sets. Rule sets are groups of rules that can be used in a scan, ensuring that only those rules that apply or are important to you are flagged as issues in your application.

To share the Rules Database, you will need to move the CRRules.dpmdb file to a shared location, and then change the DSN in the Control Panel on each machine that will use Code Review to point to this file.



There is an overall rule set called the All Rules Set which will contain every rule in the Code Review database. This includes the ones provided by DevPartner Studio and any custom rules that you create. You can then create multiple rule sets that contain different groups of rules. These can overlap, be exactly the same, be based on application, or any combination that fits your organization.

Code Review Rule Manager



03_DevPartnerStudioCodeReviewRuleManager

Code Review rules are stored in an Access database, however they can only be edited or accessed via the Rule Manager. You can launch the Rule Manger from the Start Menu (Start->All Programs->Micro Focus->DevPartner Studio->Utilities->Code Review Rule Manager), or by choosing Manage Code Review Rules from the DevPartner menu inside Visual Studio.

When you first open the Rule Manager, you will see a list of all the rules in the database in the right hand panel. On the left hand panel, you can filter the rules to see only those that match the criteria you select, or you can choose the Find tab to search for a specific rule.

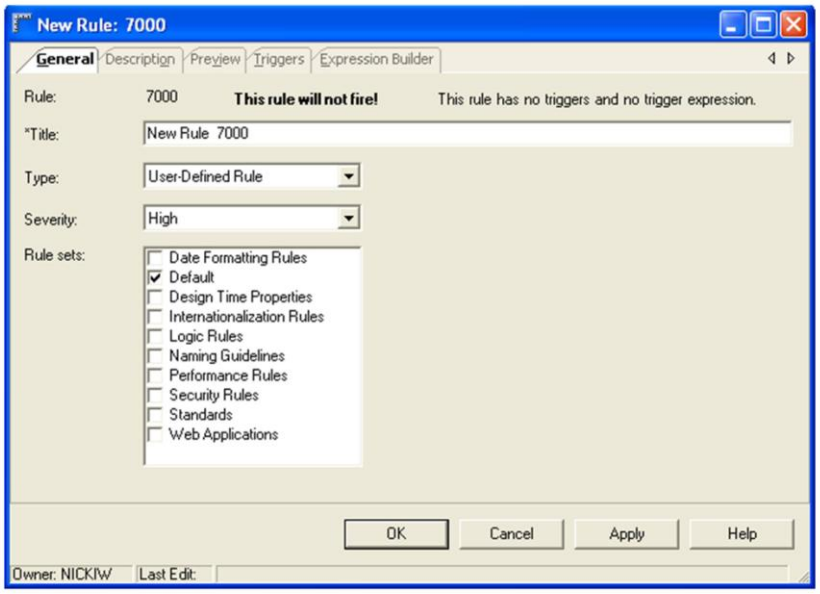
New Rule Set

03_DevPartnerStudioCodeReviewRuleManager

You can create a new rule set to designate a collection of rules to be used in a Code Review. When you create a new rule set, you'll need to give this a descriptive name and description. If you are using Hungarian name sets, you choose the name set that will be associated with this rule set and then decide which warnings will apply.

When you first create your rule set, it will contain no rules. Choose to view the Default rule set, and you can copy/paste rules into your newly created rule set. You can also start by creating new rules, and choose to include them in your new rule set.

Create New Rule



03_DevPartnerStudioCodeReviewRuleManager

To create a new rule, select the New Rule from the Rules menu item inside the Rule Manager. When creating a new rule, there are different tabs to complete. The first tab contains general information about the rule. This includes:

Number – This is generated automatically.

Title – the display name of the rule.

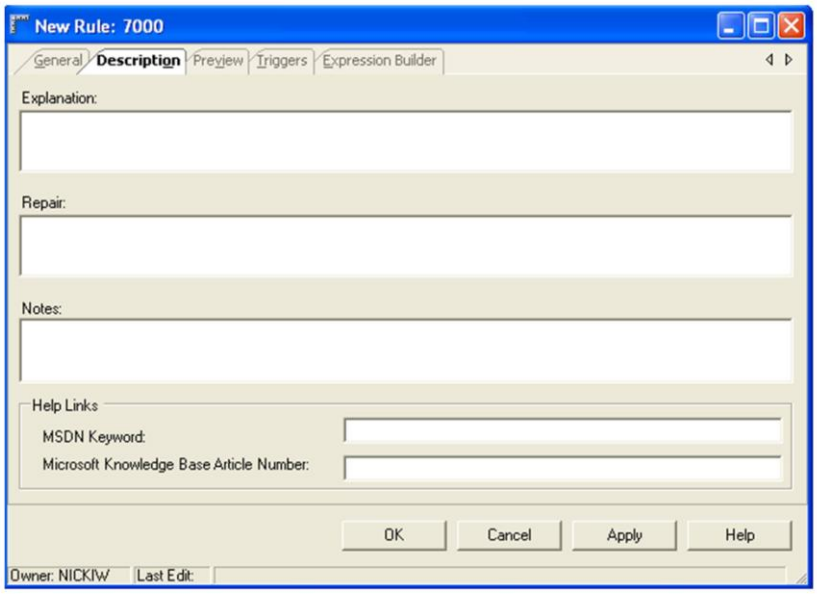
Type – the category of rule this belongs to. For example, is this a security or performance rule.

Severity – this is a way to rank the different rules, and lets you filter results to focus on the most important.

Rule set – the collection of rules that this will belong to. You can choose 1 or more rule sets for this rule to belong in.

When your rule has no triggers defined, your rule will not fire or execute during a review, and you can quickly see on this general tab that there are no triggers defined.

Create New Rule

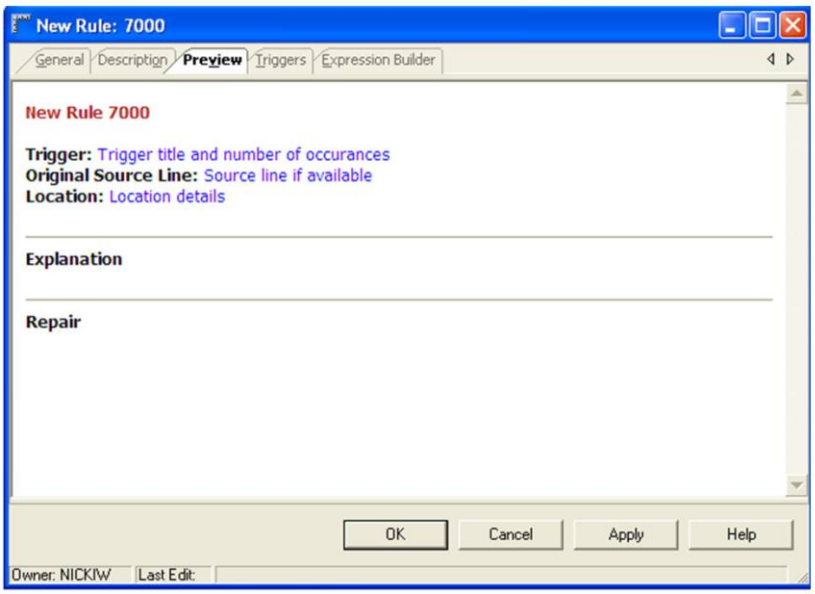


03_DevPartnerStudioCodeReviewRuleManager

The second tab in creating a new rule is the Description tab. This is what will be displayed to the user when the violation for this rule is found. This includes an explanation of why this is a problem, how to repair the code, and notes. You can also include MSDN Keywords and Microsoft Knowledge Base Article Numbers, so links to that information will be included in the explanation.

These fields accept HTML, so you can format the code to your liking.

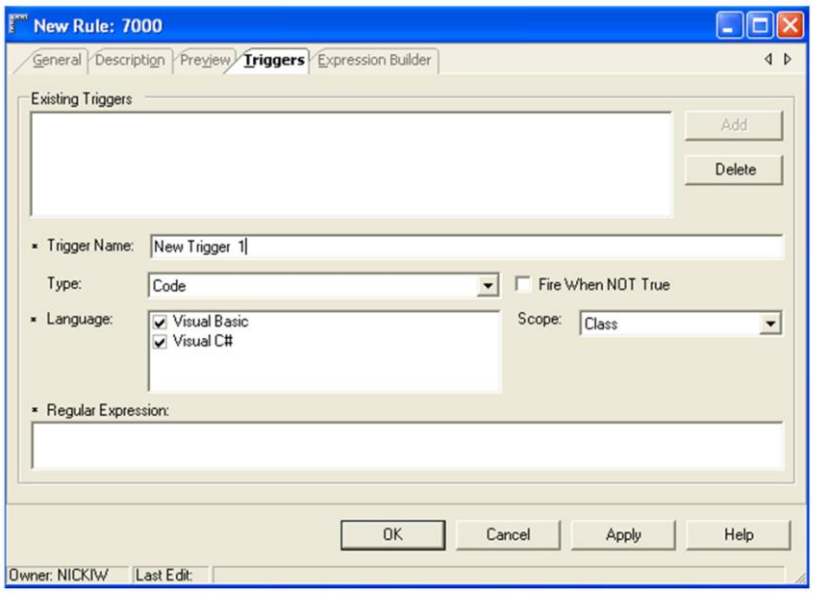
Create new Rule



03_DevPartnerStudioCodeReviewRuleManager

The preview pane will show you what the description information will look like to the end user when this rule is fired.

Create New Rule



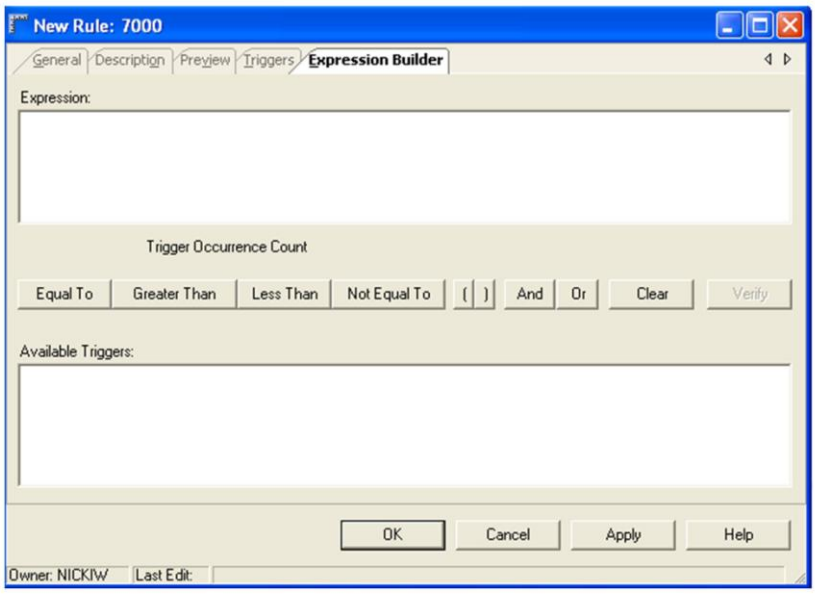
03_DevPartnerStudioCodeReviewRuleManager

Before a rule can be used and found in your application, you need to create a trigger. The trigger defines what exactly in your code will cause this problem to show up in the problems tab. The first thing you'll need to do is click the Add button. This will enable the fields to create your trigger.

You can have multiple triggers in one rule, so you'll want to give the trigger a meaningful name. You then choose what type of trigger this is. There are four types of triggers that you can create, which will determine where Code Review will scan. These four types are code, design time properties, web form page and web.config.

Depending on the type that you choose, you will need to provide information that will complete what will cause this rule to fire. In the example of a code based rule, you will need to select the language that this applies to (C# or VB.NET), define the scope (for example class or line scope), and the regular expression to match.

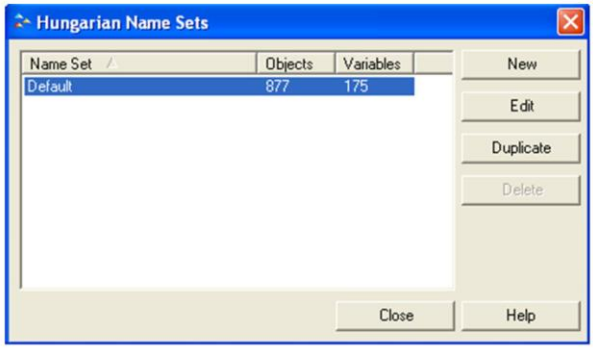
Create New Rule



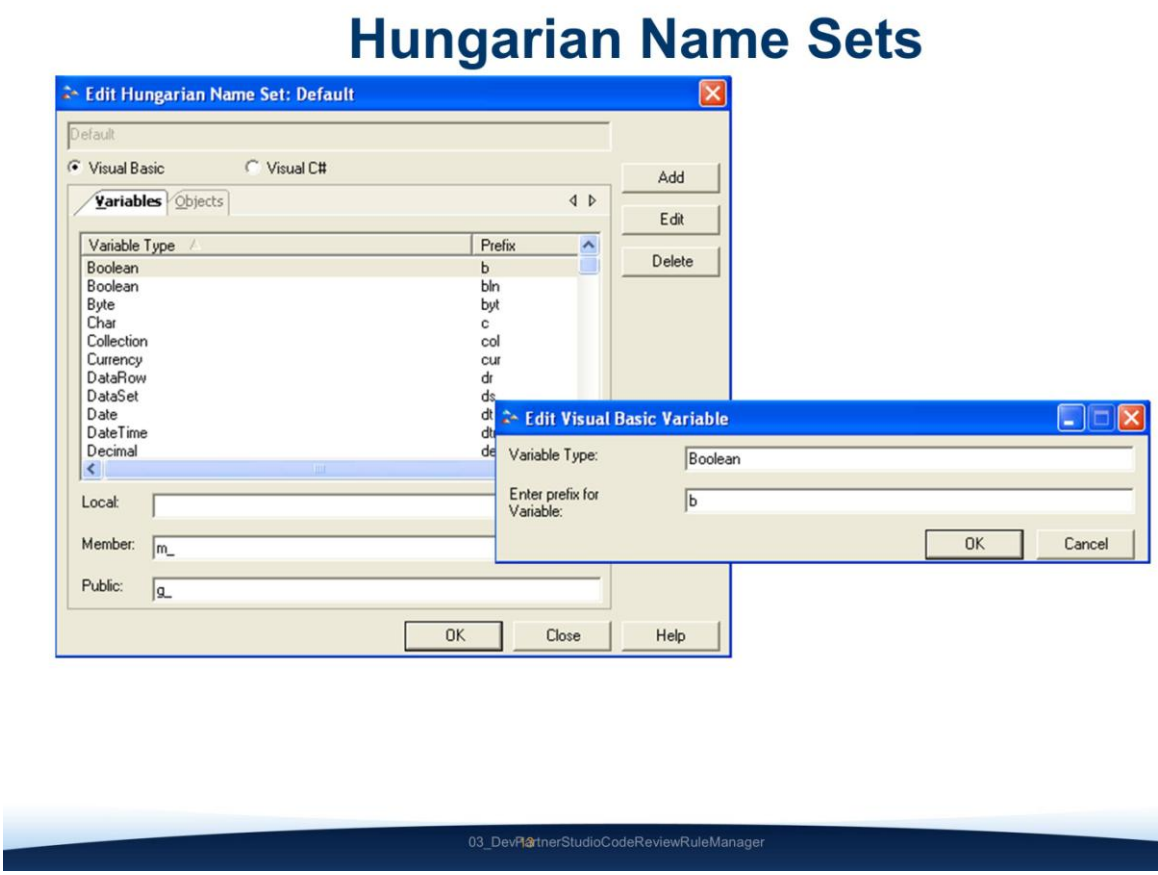
03_DevPartnerStudioCodeReviewRuleManager

You can create multiple triggers for one rule. The expression builder tab is where you define the combination of triggers that will cause this issue to be flagged during a Code Review.

Hungarian Name Sets



If you use Hungarian Name Sets in Code Review, you can edit or create new naming sets inside the Rule Manager. There is a default name set provided. You can edit this default name set, or duplicate it and edit the new name set to make changes to fit your organization. You can have multiple name sets, which may be needed for different projects or different areas of your organizations.



When you edit an existing name set, you can see the list of variable and objects with their preferred prefix. Along the bottom, you can also see the prefixes based on scope. To edit an individual variable or object prefix, you can double click or click the edit button.

Module Exercise

Please turn to your Exercise Guide and complete

03_DevPartner StudioCodeReviewRuleManager-EG -EG: Exercise 1

Module Exercise

Please turn to your Exercise Guide and complete

03_DevPartner StudioCodeReviewRuleManager-EG -EG: Exercise 2

Module Exercise

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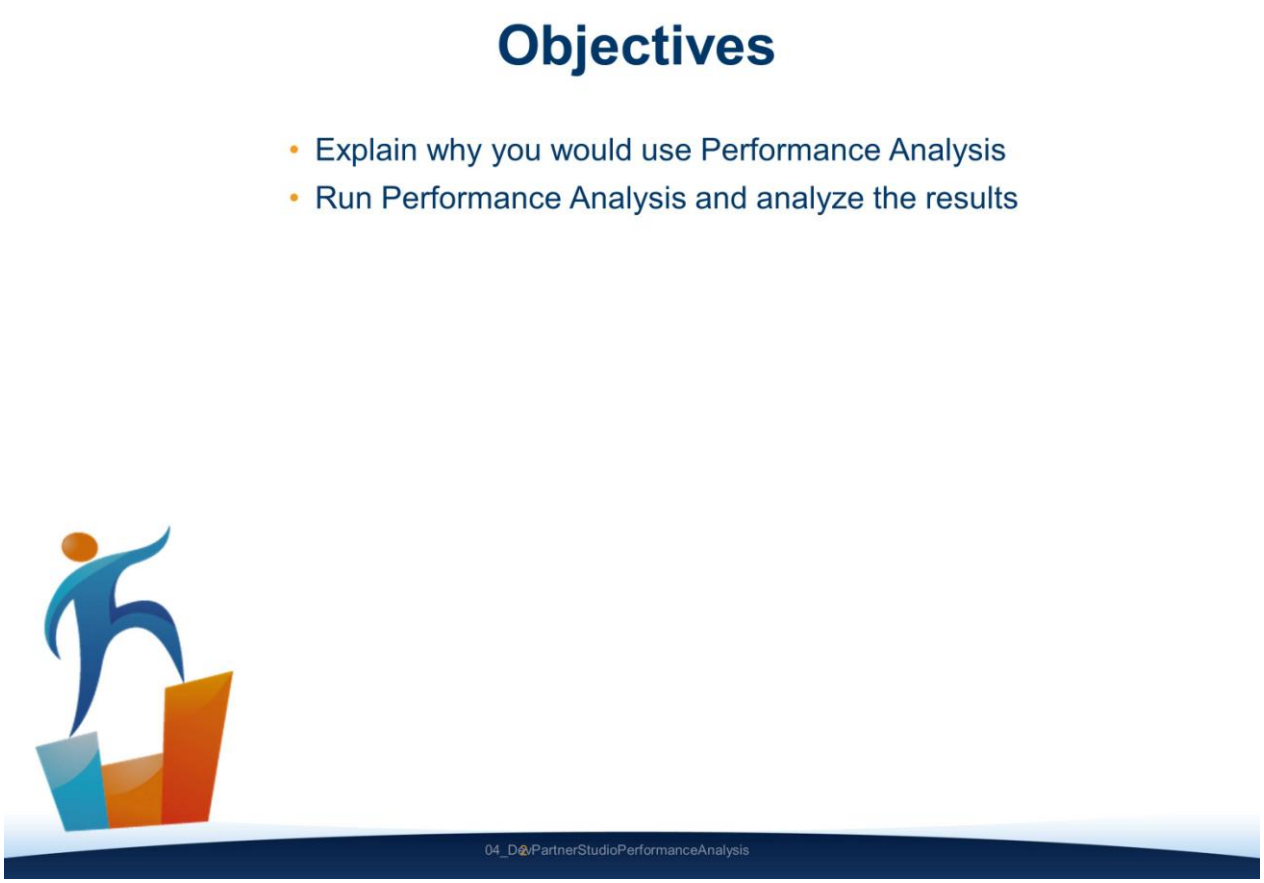
03_DevPartner StudioCodeReviewRuleManager-EG: Exercise 3

Performance Analysis



This module of the course is intended to provide an overview of the Performance Profiler module of DevPartner Studio. By the end of this module, you should be able to understand why you would use Performance Profiler, be able to run Performance Profiler and analyze the results.

What is Performance Analysis?

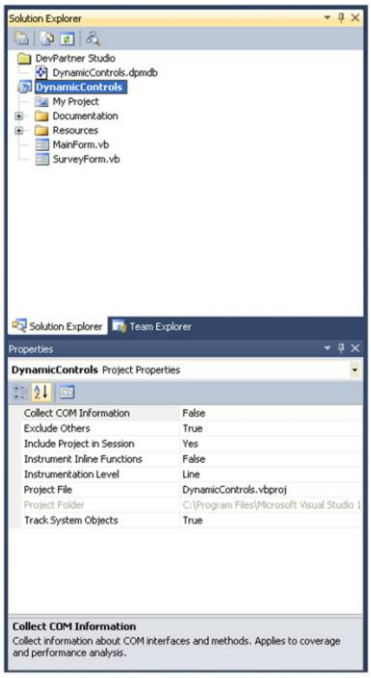
- Used to collect performance data for images, source files, assemblies, methods, functions and individual lines of code.
- Collect information about only threads of your application.
- Makes it easy to pinpoint performance bottlenecks:
  - In your code
  - In third party components
  - In the operating system

Performance Analysis lets you gather performance data for many different applications. You can quickly see where performance bottlenecks are in your application, as well as areas with no source code. For those items that you have source code for, you can drill down to the method and source code line to see timing details.

You can easily see how much time is being spent in threads of your application, while excluding any time spent in threads from other applications.

Performance Analysis can be run with your .NET and native C++ applications.

Performance Analysis Options



There are options that you can set for performance analysis that can be found in the Visual Studio property area when you have a project or solution selected. The options that are applicable to performance profiling are:

Collect from .NET - determines whether to collect from any managed code application started from Visual Studio. The default is True.

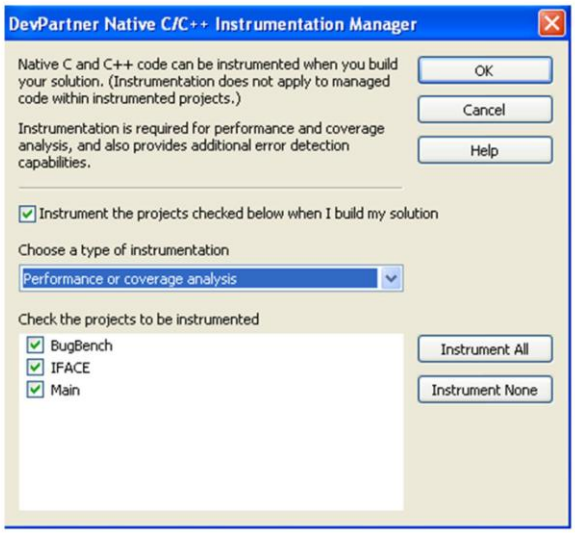
Collect COM information – the default is True, in order to collect method level data on DLL exports and COM interfaces.

Excludes Others – will exclude time spent in threads of other running applications.

Instrument Inline Functions – set this property to True to instrument inline functions. Default is set to False.

Instrumentation Level – defines whether you are going to instrument applications to gather Method or Line level information. The default is for Line level. Line level will allow you to drill down to details for each line in your source code, while method level provides information at the method level, but will improve the performance analysis speed.

Instrumentation



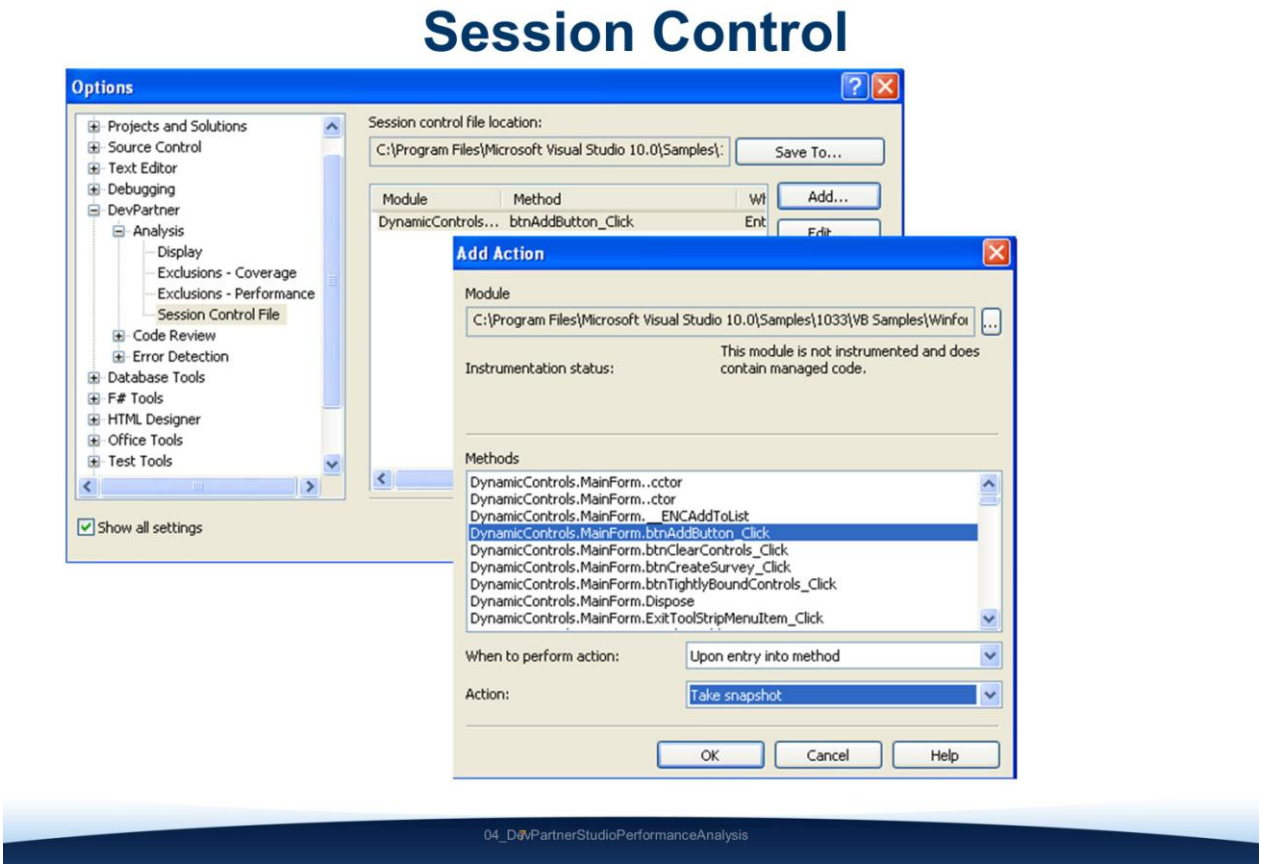
You can use Performance Analysis with your native C++ applications, however there are some additional steps that need to be taken before you can collect timing data. For C++ code, you need to ensure your application is instrumented. You can use the Instrumentation Manager from inside Visual Studio by choosing the DevPartner->Native C/C++ Instrumentation Manager menu item. Here you need to choose the type of instrumentation to use, and which projects to instrument. Once you've set up the instrumentation, you also need to ensure it's enabled. You can do this by choosing the DevPartner->Native C/C++ Instrumentation menu item. You can tell that this is enabled by the icon being highlight/outlined. These options can also be set with toolbar actions.

Session Control

04_DevPartnerStudioPerformanceAnalysis

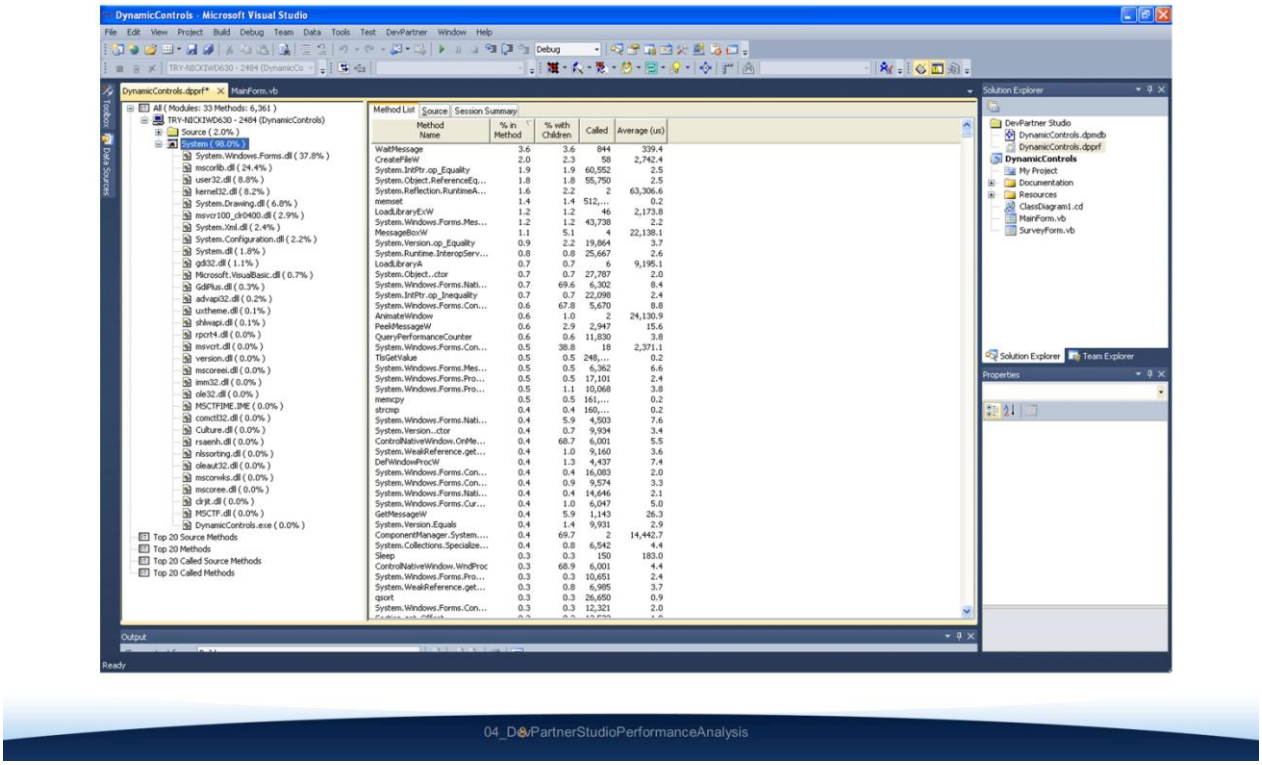
You can run Performance Profiler by choosing the DevPartner->Start Without Debugging with Performance Analysis, by choosing the Performance Analysis button in the toolbar, or by running from the command line (which will be covered in another module).

You can also choose to focus your profiling on specific areas of your application. You can do this in a few ways. When you start your application with profiling, you are starting to gather information. You can walk through your application and choose to close your application when you are finished with the areas that you'd like to profile. Your results will then be based on all the actions you took through your application. The recording controls are also available during your recording session. You can choose to start your application with Performance Analysis and walk through a portion of your application that you don't want to gather information about. At that point, you can click the button to clear all recorded data (the x in the screenshot above). The recording controls will appear inside the Visual Studio toolbar, if you are running your session from inside Visual Studio. If you are running from the command line, the recording controls will be their own window. At this point, your results are "blank". You can then walk though the portion of your application that you are looking to profile. Once you're at the point that you'd like to view your results, you can either click the snapshot button (which will show you the results up to that point and allow you to continue collecting data), or you can stop profiling by choosing the stop button or by closing your application.



The other way to control the areas for profiling is by creating a Session Control File. You can choose specific methods that, based on entry or exit, you clear data, take a snapshot, or stop execution and take a final snapshot. You can define these details inside the DevPartner Options, under Session Control File.

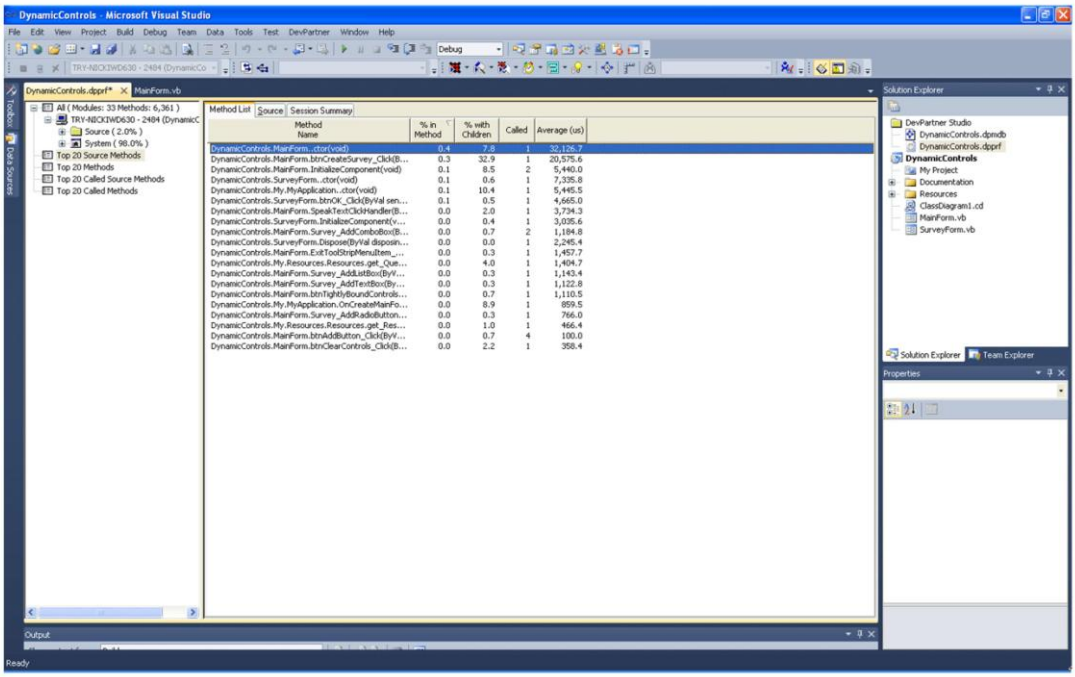
Performance Analysis Results



Once you've run Performance Analysis and either ended a session or taken a snapshot, you will have a session file. The session file will have two panes. On the left is a navigation pane, with a details pane that appears in the middle of the screen.

In the DevPartner navigation area, you can see a break down of how your application performs. You can see how much time was spent in your source code vs. time spent in system or 3rd party components. If you select a component, or source file, the details pane will populate with information only for that selected item.

Filters



04_DevPartnerStudioPerformanceAnalysis

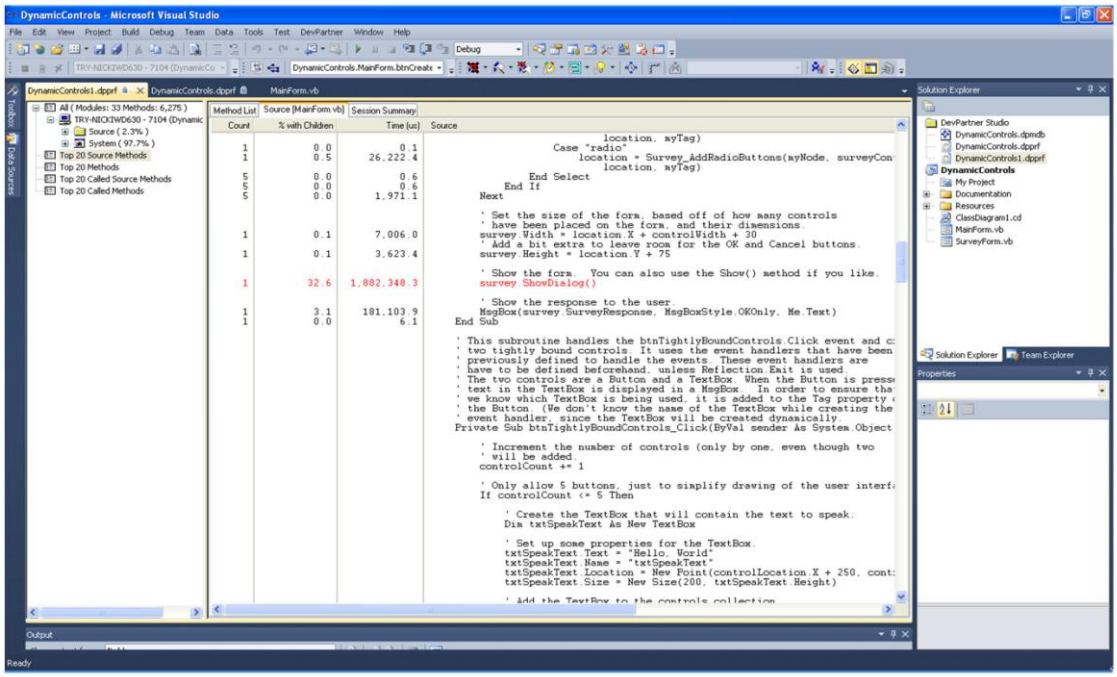
In the DevPartner navigation area, below the breakdown for source vs. system components, are a group of filters that you can use to quickly drill down to those things that are most important to you. For example, you can quickly see the 20 source methods that are taking the most time. When you select a filter, the details pane will show you only those items that match the filter.

The details pane will contain a list of the methods for the selected item in the navigation pane. You can view details such as the % of time spent in that method, the % of time spent with children calls, how many times this method was called, and the average time spent inside this method. There are other columns available, and you can select them by right clicking in the method list and selecting Choose Columns. This will open an interface to select the columns that you want to view.

Call Graph

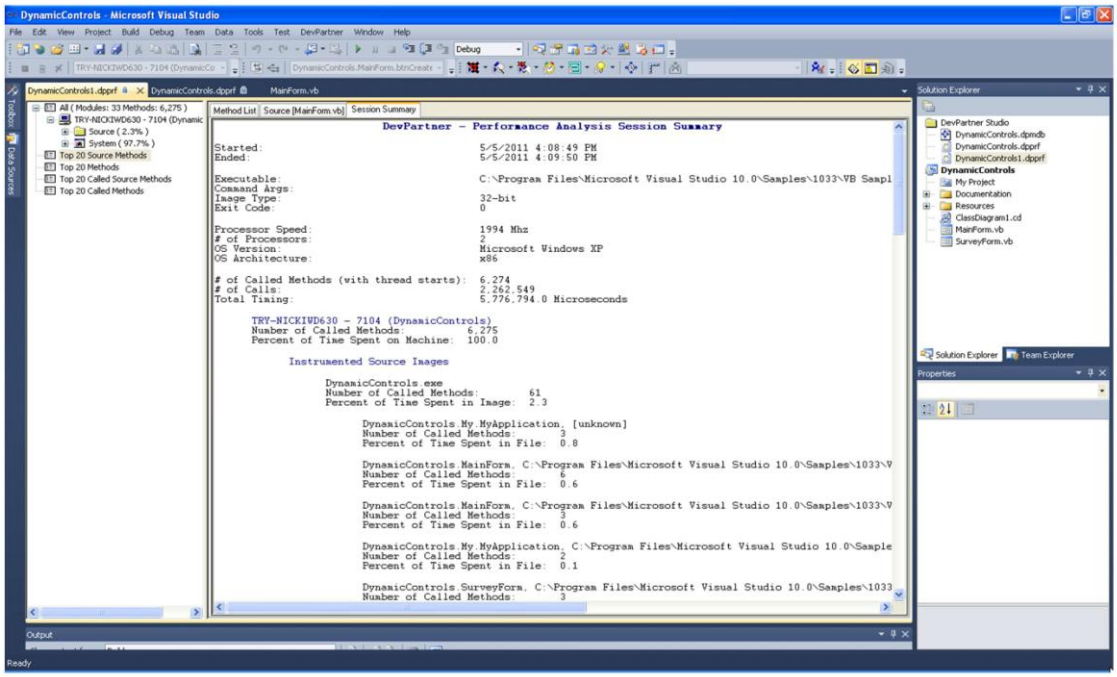

Call Graph
DynamicControls.M...
5.1 %
91.5 %
DynamicControls.M...
1.6 %
36.5 %
System.Windows.Form...
1.2 %
97.2 %
System.Windows.Form...
3.0 %
2.4 %
28.5 %
1.3 %
0.4 %
System.Windows.Fo...
3.1 %
7.9 %
System.Windows.Form...
0.0 %
0.1 %
System.Windows.Form...
9.6 %
0.3 %
0.1 %
0.1 %
strcmp
100.0 %
4.0 %
ControlCollection.Add
0.1 %
0.0 %
System.Windows.Form...
46.7 %
0.0 %
memset
100.0 %
3.1 %
2.8 %
0.0 %
2.3 %
System.Windows.Form...
0.0 %
0.0 %
memset
100.0 %
0.0 %
System.Windows.Fo...
5.4 %
2.3 %
System.Windows.Form...
1.1 %
0.0 %
System.Windows.Form...
27.4 %
0.0 %
1.7 %
0.0 %
VirtualAlloc
100.0 %
1.6 %
System.Windows.Form...
1.0 %
0.0 %
VirtualAlloc
100.0 %
0.0 %
1.1 %
0.0 %
strcmp
100.0 %
0.9 %
System.Windows.Form...
3.3 %
0.0 %
strcmp
100.0 %
0.0 %
0.7 %
0.0 %
memcpy
100.0 %
0.5 %
System.Windows.Form...
2.0 %
0.0 %
QueryPerformanceCou...
100.0 %
0.0 %
0.4 %
0.0 %
InitializeCriticalSec...
100.0 %
0.3 %
System.Windows.Form...
1.1 %
0.0 %
System.Windows.Form...
13.3 %
0.0 %
0.3 %
0.0 %

Source Code



When you right click on a method and choose Go to Method Source, you will be shown the results at the line level. This level of information is only available if you have enabled Line Level collection, and if you have the source code available. Here you will be able to see the amount of time that it took for each line of code. The line that took the longest in each method will be highlighted for you.

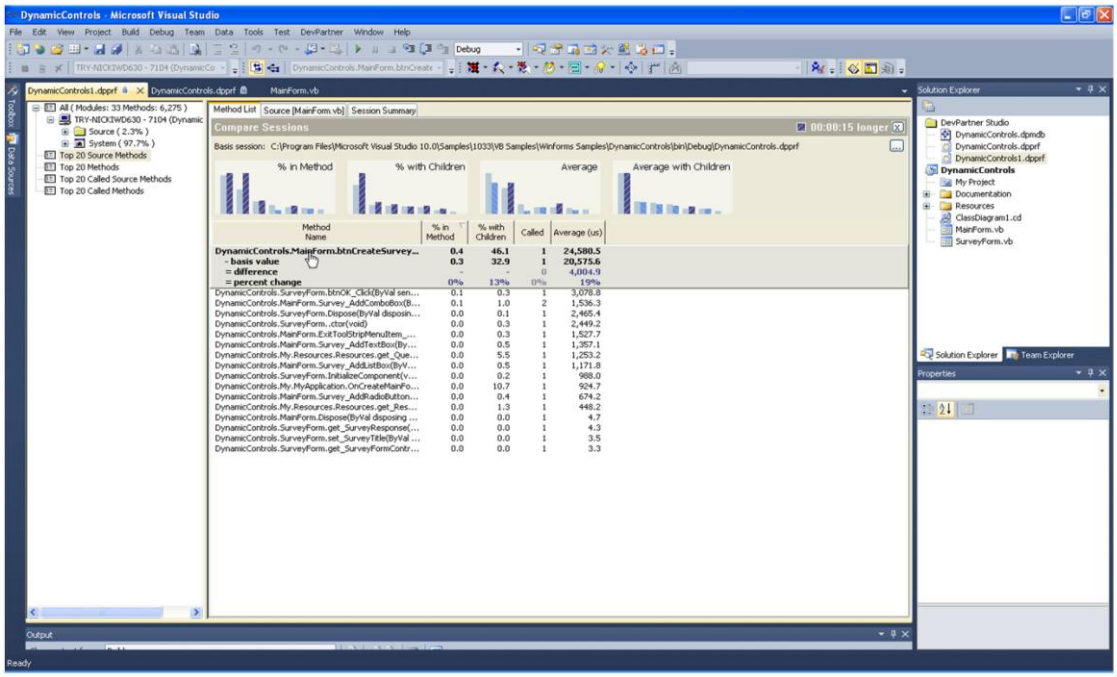
Summary



04_DevPartnerStudioPerformanceAnalysis

The summary tab will show you high level information about your performance analysis session.

Compare



Once you've made changes to your application code to improve performance, you can run performance analysis again. To see if you made an improvement to the performance of your application or not, you can choose to compare session files. With a session file open (the new one that you'd like to compare), you can right click in the method list and choose Compare. You will be asked for the location of the baseline file, so navigate to the performance results. You will then be able to see a comparison, and when hovering over a particular method, you will be able to see the % of improvement, or % of degradation to the performance.

Module Exercise

Please turn to your Exercise Guide and complete

04_DevPartnerStudioPerformanceAnalysis-EG: Exercise 1

Performance Expert

Objectives

- Explain why you would use Performance Expert
- Run Performance Expert and analyze the results

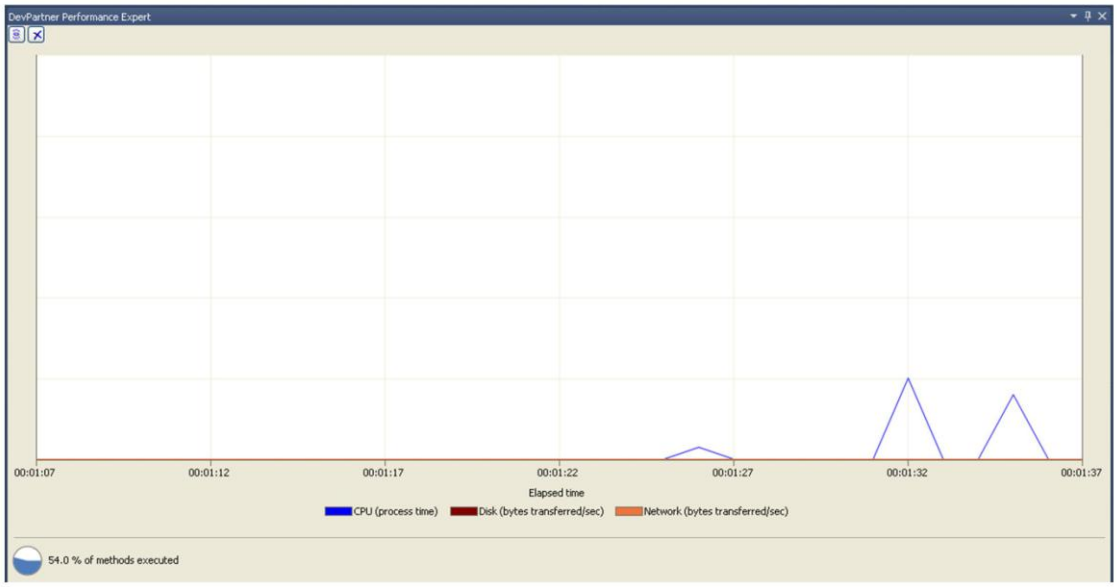
This module of the course is intended to provide an overview of the Performance Expert module of DevPartner Studio. By the end of this module, you should be able to understand why you would use Performance Expert, be able to run Performance Expert and analyze the results.

What is Performance Expert?

- A performance analyzer that helps you locate bottlenecks in code, by giving you detailed analysis on the types of activities your application is performing.
- Takes performance profiling a step further and gives insight into:
  - CPU/thread usage
  - Disk I/O
  - Network I/O
  - Synchronization wait time

Performance Expert gives you more insight into the performance of your .NET applications by providing additional details on not just the amount of time spent on threads of your application, but also giving you details on the Disk and Network activity and the amount of Synchronization wait time.

Performance Expert

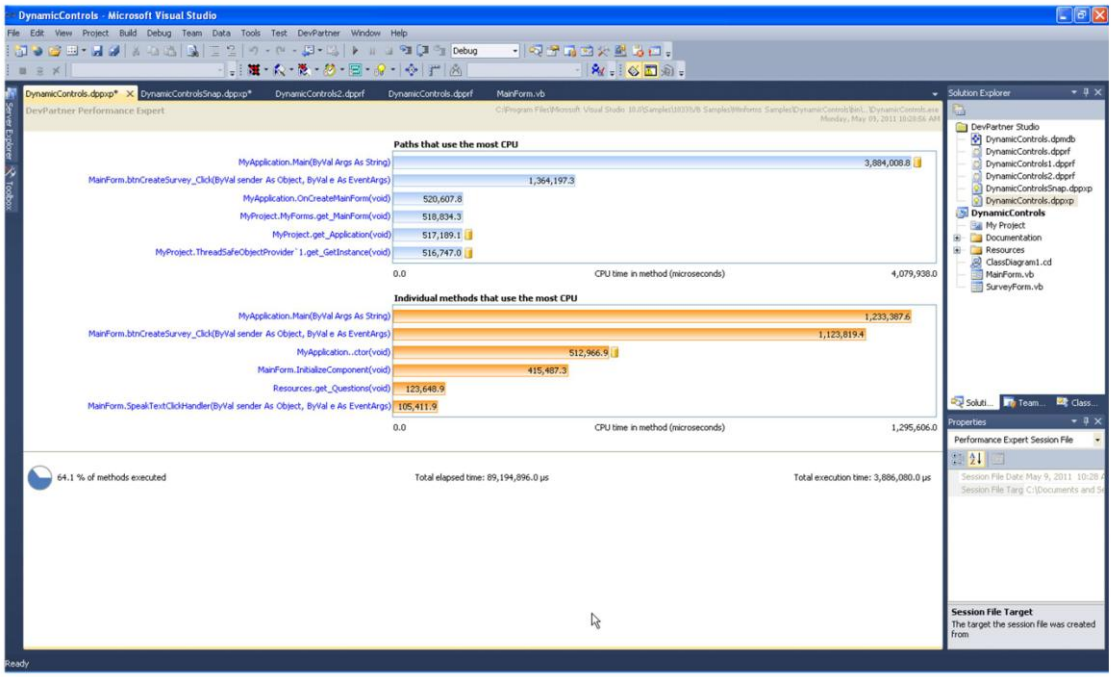


05_DevPartnerStudioPerformanceExpert

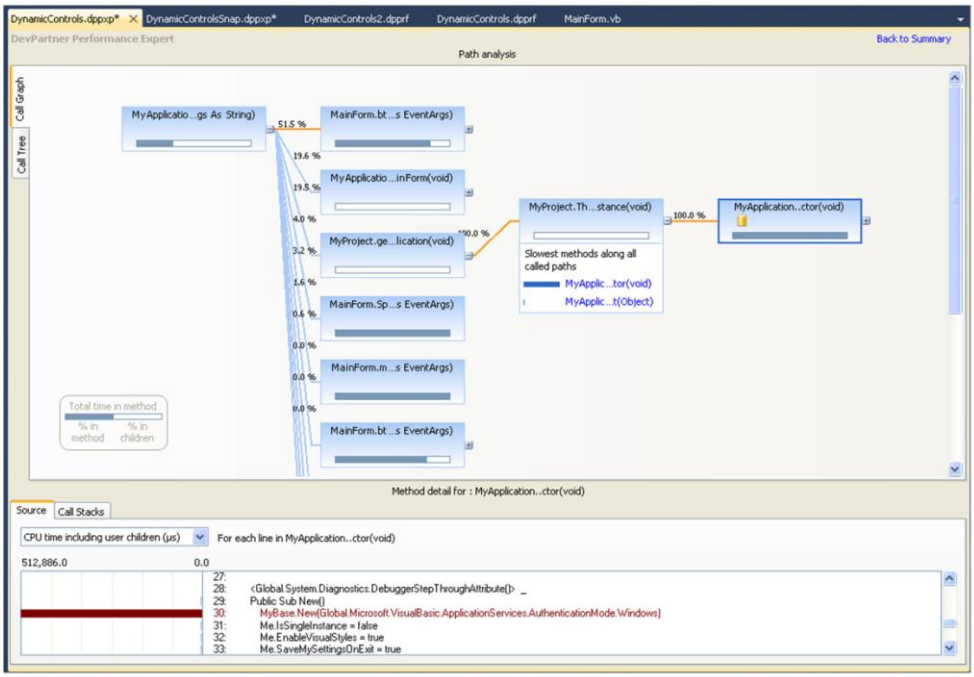
You run Performance Expert by choosing Run Without debugging with Performance Expert from the DevPartner menu item, or choosing the Performance Expert button on the toolbar. This will start up your application, with Performance Expert collecting information in the background.

Performance Expert has a run-time view that lets you see the activity taking place during the run of your application. You can also choose to stop collecting Performance Expert information or take a snapshot of the information collected so far. Another way to end collection is to close your application.

Performance Expert



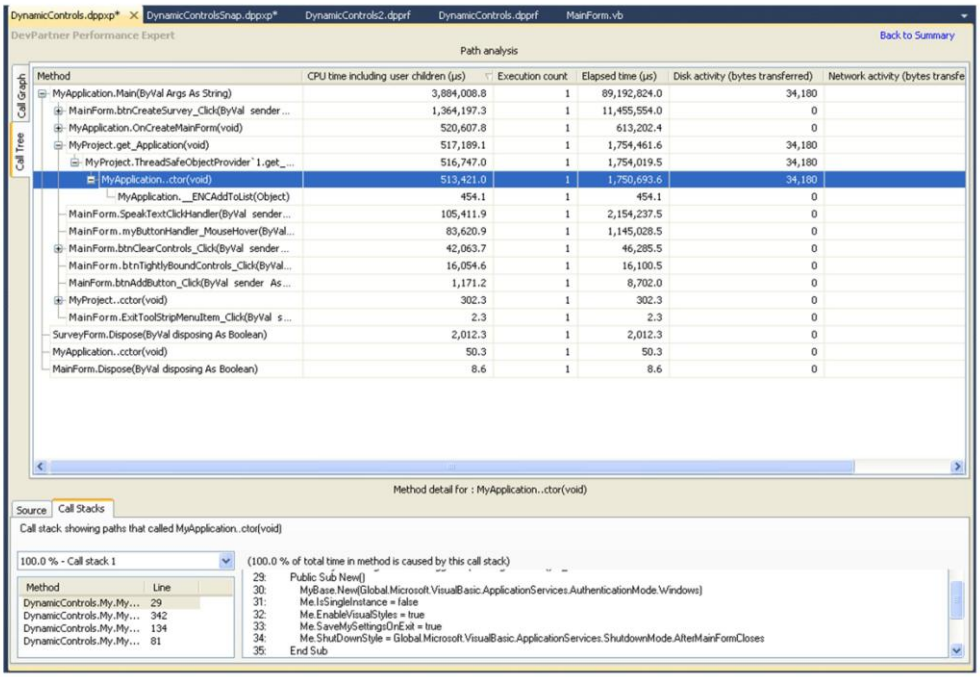
Performance Expert



If you drill into the details for a path that is using the most CPU, you will be able to see information about the different paths in a couple of different views. The first view is a call graph view. You can expand each path, and selecting any method in the path will show you source code details in the bottom of the panel. Each method that has Network and Disk activity will have an icon that appears in the call graph.

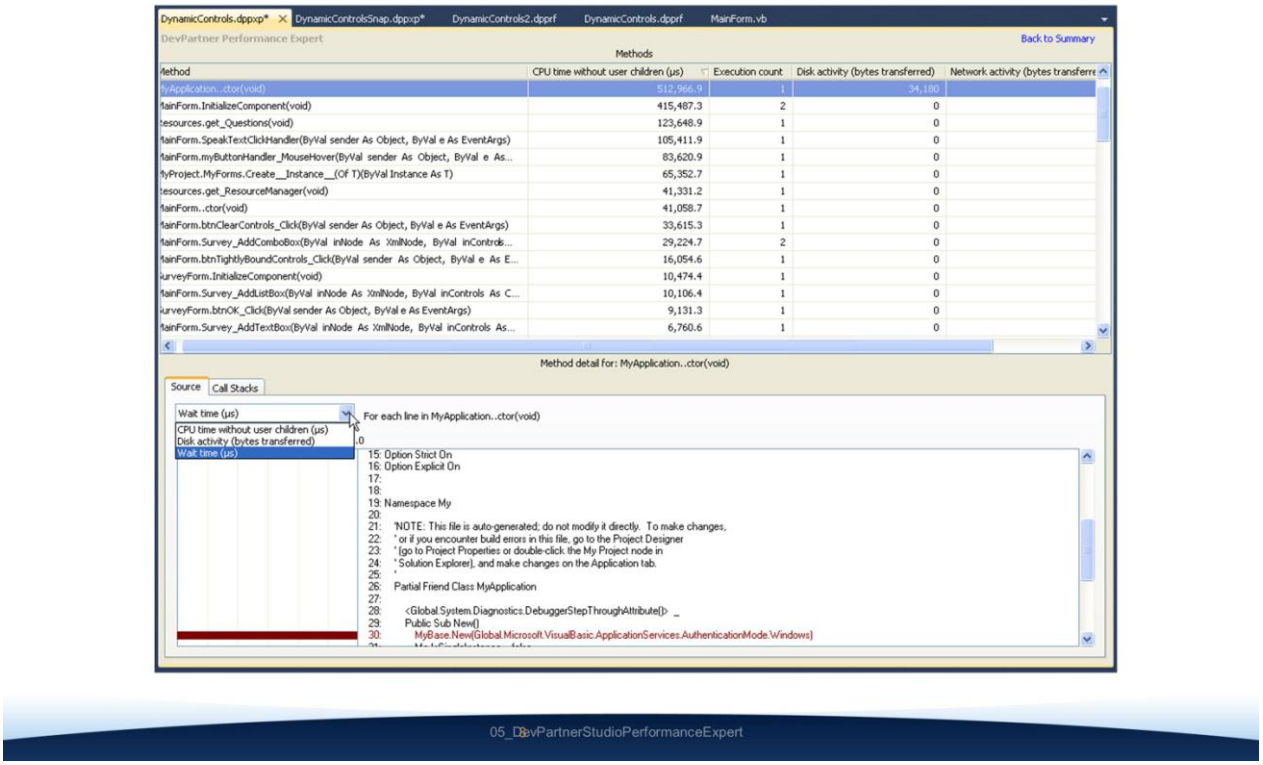
The lower panel shows details for each method, with line level information. In this example, you can see information on the CPU time including children calls. The bar to the left of the source code is a relative graph, showing the line that took the most CPU time in red, with the bar extended all the way to the left. For methods that have disk activity, network activity, or wait time you can choose to view source code information by choosing those different items from the drop down list in the lower panel.

Performance Expert



05_DevPartnerStudioPerformanceExpert

If you'd like to see the call graph information in a different way, you can choose the call tree tab on the left hand side. This will show you the same call graphs, but in a tree view, which allows you to also choose the columns and data presented to you.



If you choose to drill down into a specific method from the summary page, instead of a path, you will see a list of all the methods called in your application and can view performance information including the CPU time, disk and network activity. When you select a method from the list, the source code pane will be populated with the details.

The lower panel shows details for each method, with line level information. The bar to the left of the source code is a relative graph, showing the line that took the most time in red, with the bar extended all the way to the left. For methods that have disk activity, network activity, or wait time you can choose to view source code information by choosing those different items from the drop down list in the lower panel.

Module Exercise

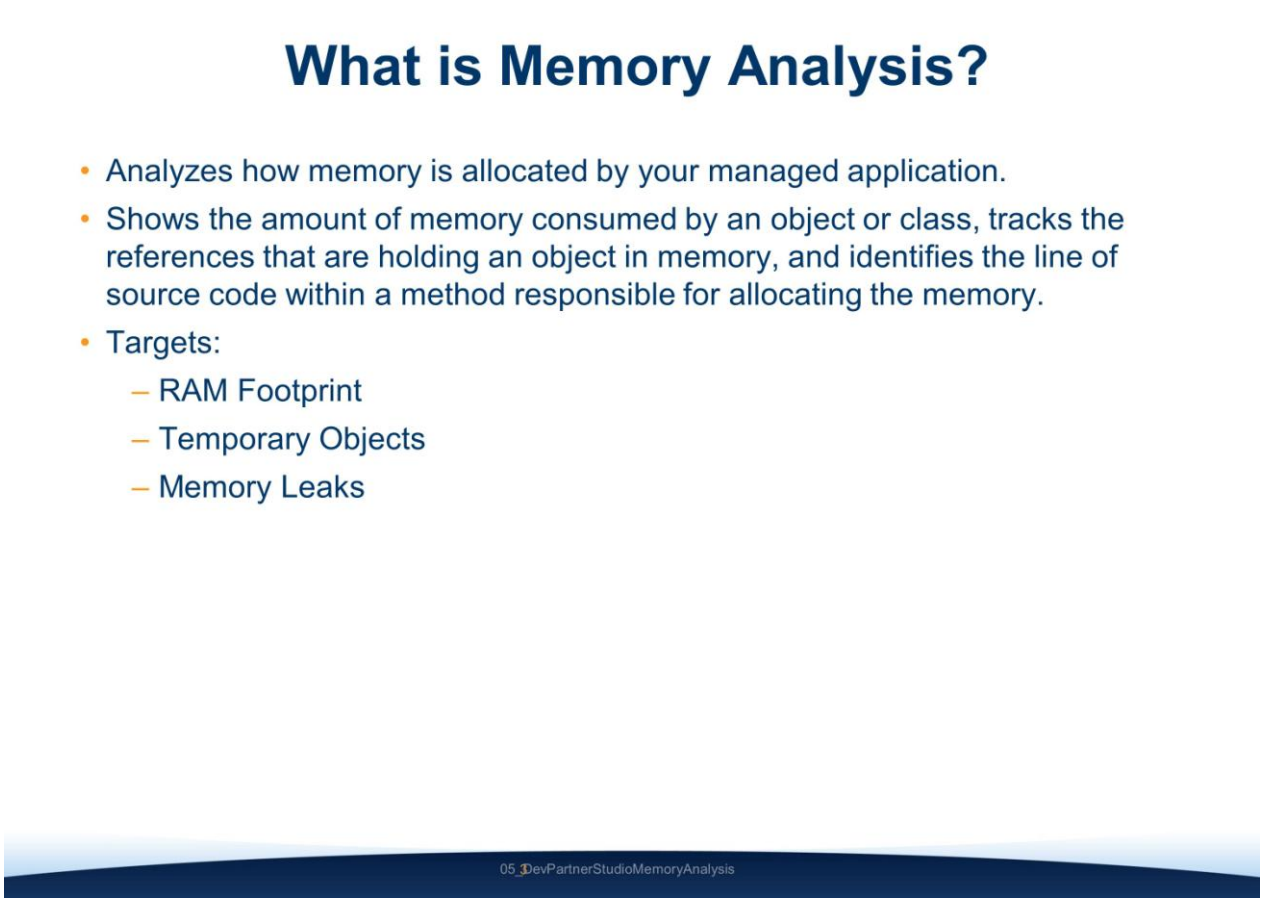
Please turn to your Exercise Guide and complete

05_DevPartnerStudioPerformanceExpert-EG: Exercise 1

Memory Analysis

Objectives

- Explain why you would use Memory Analysis
- Understand which type of Memory Analysis to use to find different types of problems.
- Run Memory Analysis and analyze the results



Memory Analysis is designed to track how memory is being used by your .NET applications.

You can use Memory Analysis to monitor the underlying RAM footprint of your application, track temporary objects and locate memory leaks. In this module, we will walk through the different analysis types available, when you would use each type of analysis and view the results of each of these memory analysis types.

Symptoms and Analysis Tools

Symptom	Use Analysis Tool
Performance degrades over time; recovers on restart. Performance improves after restarting the application, but degrades again.	❑ **Memory Leaks**
Scalability problems; temporary performance degradation	❑ **Temporary Objects** ❑ **Memory Leaks**
Sluggish performance, does not improve after restarting the application	❑ **RAM Footprint** ❑ **Temporary Objects**

There are many symptoms that your application can display to indicate memory issues with your application. This chart outlines some of the things you may see in your application, and the type of memory analysis you will want to use to try to fix them.

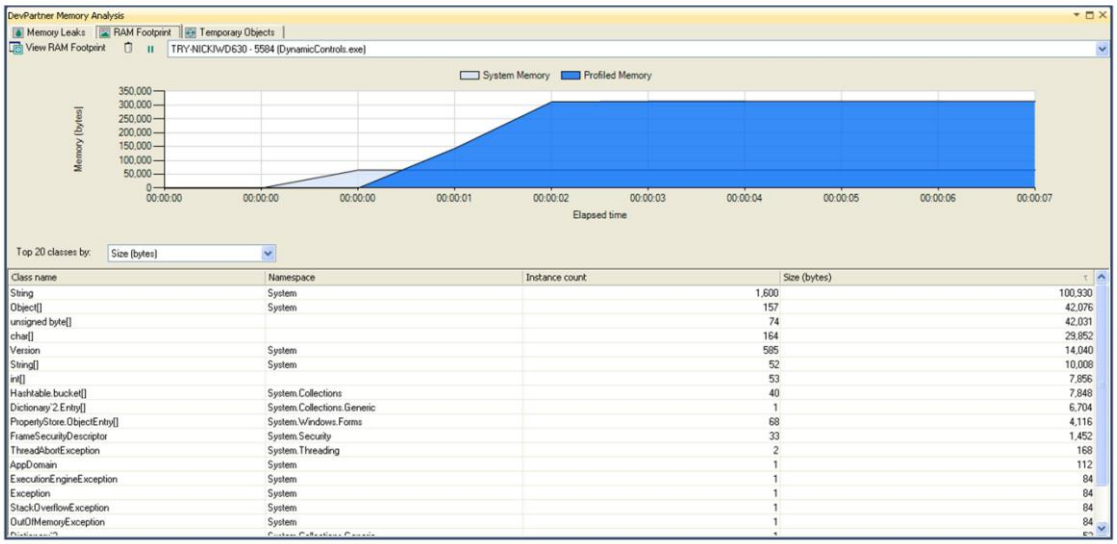
RAM Footprint

- Refers to the amount of memory that a program uses when it is in an idle, steady state.
- Minimum amount of memory the program requires to run.
- Warm up your application to get lazy initializations out of the way.

RAM footprint is the minimum amount of memory your application needs to run. When your application performs work, it will allocate and free temporary objects, which can consume more memory but does not affect the basic, underlying footprint.

To gather RAM footprint information about your application, start your application with Memory Profiling. You can choose the DevPartner->Start without Debugging with Memory Analysis memory option. This will enable profiling for all 3 different analysis type. You choose the tab that is appropriate for the analysis you'd like to perform.

Ram Footprint



When you start profiling, you will be able to see some runtime information including a graph showing profiled and system memory, and a list of classes. You will want to warm up your application, and return to an idle steady state. For example, you may want to walk through completing an order and return to the home page of your application. You then will want to click the button to force garbage collection, and the class list will now show the basic make-up of your managed heap while in the steady state.

When you click View RAM Footprint, you will take a snapshot of the managed heap. This does not stop memory analysis.

RAM Footprint

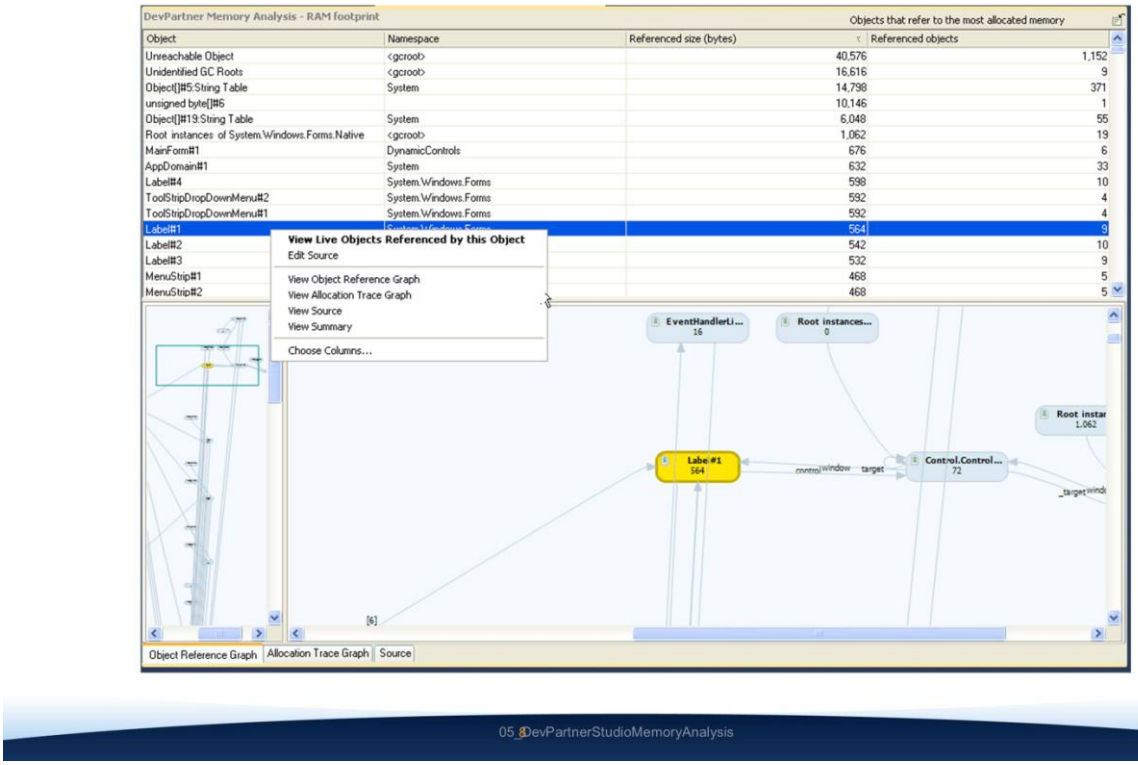
The RAM footprint summary shows the objects and methods consuming the most memory when the snapshot was created.

The object distribution will show you a pie chart giving you a high level view of where memory is being allocated in your application. It shows the relative amounts of memory consumed by profiled objects and system objects.

You can see the objects that refer to the most allocated memory, which show the objects that held references to live objects when the snapshot was created. You can click on Show Complete Details to view the complete list of large referring objects in memory.

There is also a chart that shows methods that allocated objects that use the most memory. You can view the complete details that will show a list of the methods invoked by your application with memory information.

Ram Footprint



When you view complete details on the objects that refer to the most allocated memory, you will see the details in a table, with each object and it's details provided. Organizing the data by objects that hold references to allocated memory lets you focus on large objects, or those that the maximum amount of memory could be reclaimed if they could be collected by the garbage collector.

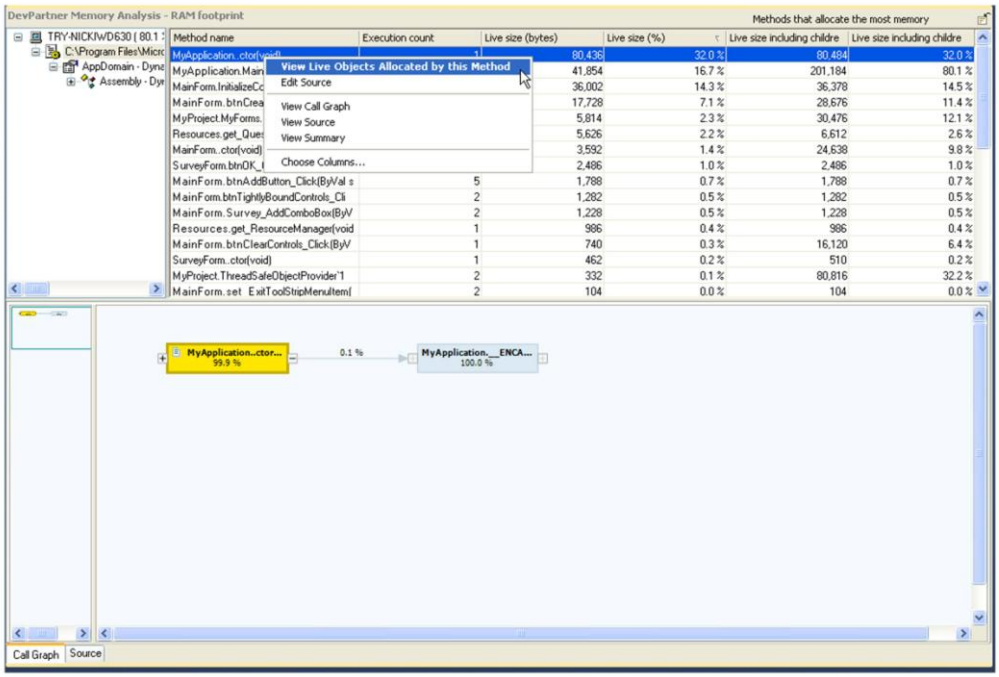
If you right click on an object, you will be able to view information about that object. You can view:

Live Objects Referenced by this Object – see all the live objects referenced by this object, and you can continue to drill down the chain of referenced objects this way.

Object Reference Graph - the chains of object references that prevent objects from being collected by the garbage collector.

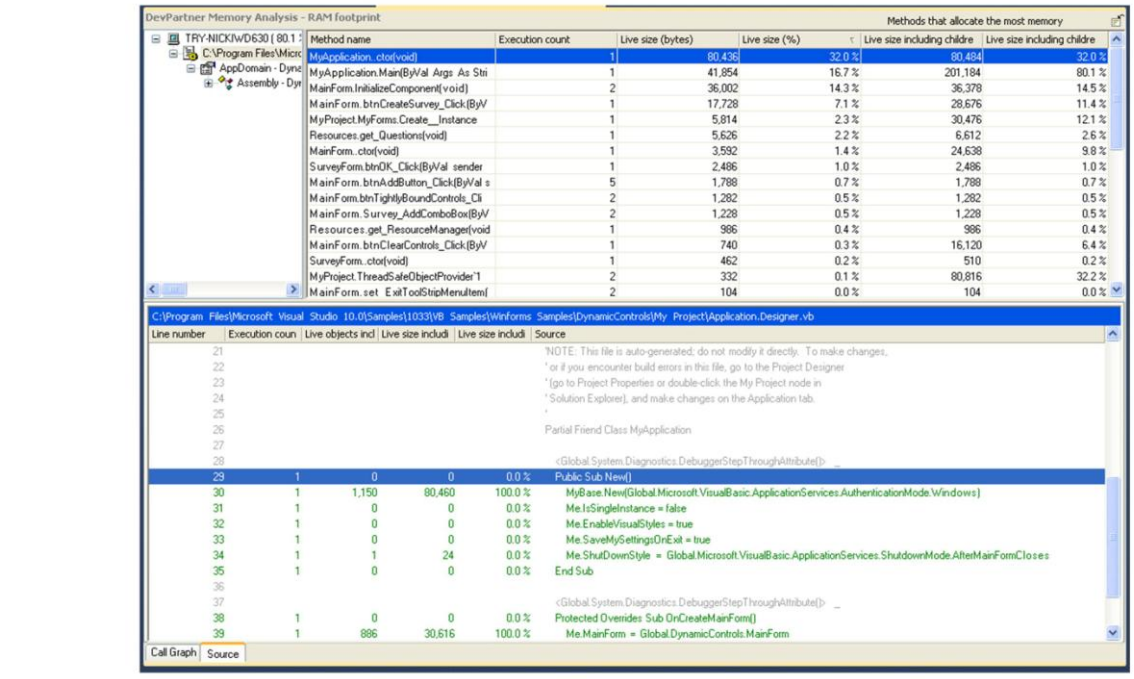
Allocation Trace Graph – the sequence of method calls that allocated memory of the objects.

RAM Footprint



When you choose to view complete details for methods, you will be provided with a list of the methods that were called during the execution of your application in a table, with information about memory usage and size of memory that was live at the time the session file was generated. You can see the call graph, so you can trace to the objects that were allocated due to children calls. You can also drill into the list of live objects allocated by this method.

RAM Footprint



You can quickly drill down to the source code view. This will show you details on all live objects allocated by each line of code.

Module Exercise

Please turn to your Exercise Guide and complete

06_DevPartnerStudioMemoryAnalysis-EG: Exercise 1

Temporary Objects

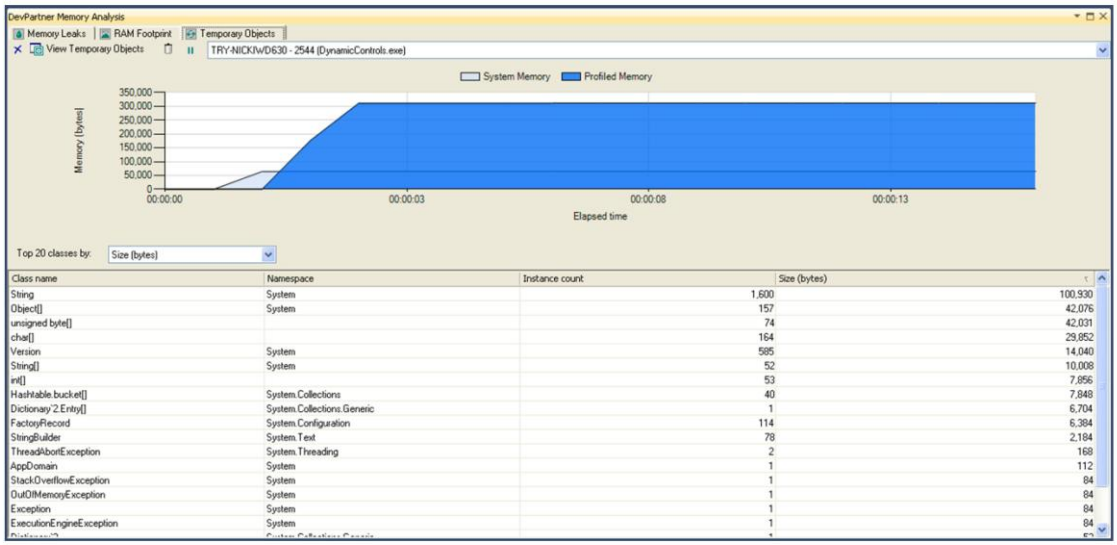
- Objects that are allocated and quickly garbage collected.
- DevPartner tracks the object allocated by your code and categorizes them based on how long it takes for them to be collected.
  - Short-lived – collected at the first garbage collection after the object was allocated (generation 0)
  - Medium-lived - collected at the second garbage collection after allocation (generation 1)
  - Long-lived- survives across many (or all) garbage collections during the run of the program
- DevPartner combines short-lived and medium-lived object allocations in a temporary category.

Temporary objects are objects that are allocated and quickly garbage collected. DevPartner tracks the objects allocated by your code and organizes them based on how long it takes for them to be collected.

Short lived objects are collected a the first garbage collection after the object was allocated (also referred to as generation 0). Medium lived objects are collected at the second garbage collection after allocation (also referred to as generation 1). Long lived objects survive many or all garbage collection during the run of your application. DevPartner combines the short and medium lived object allocations into a temporary category.

Medium-lived objects can have the greatest impact on performance and cause the garbage collector to work harder than needed. Individual short-lived objects have less impact on garbage collection, however creating large numbers of short-lived objects might cause bottlenecks and memory shortages.

Temporary Objects



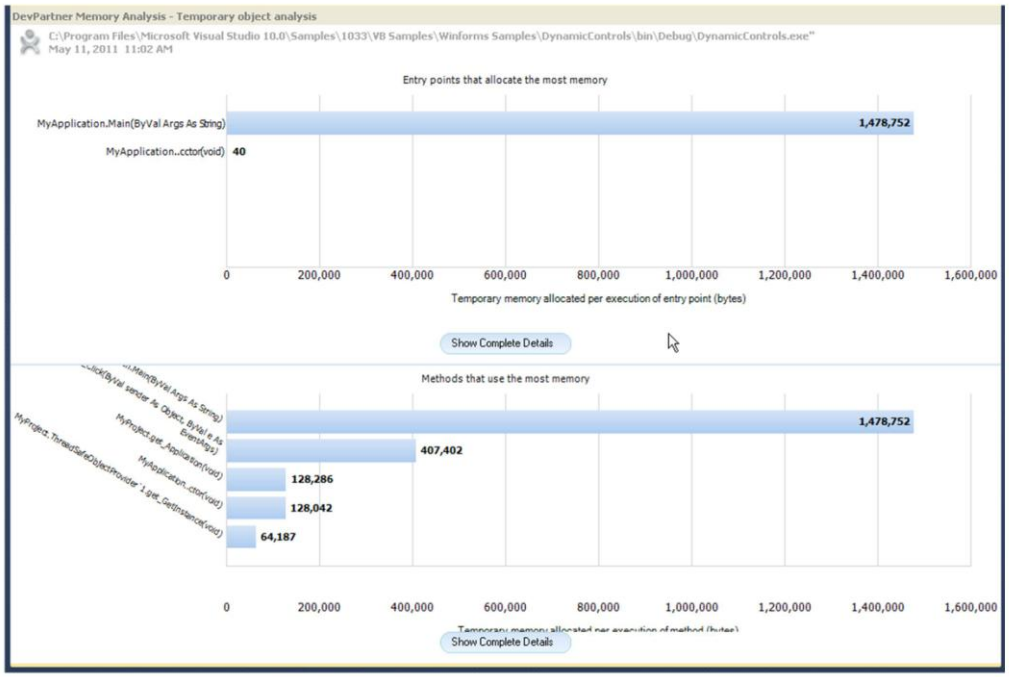
To gather temporary object information about your application, start your application with Memory Profiling. You can choose the DevPartner->Start without Debugging with Memory Analysis menu option. This will enable profiling for all three different analysis types. You choose the tab that is appropriate for the analysis you'd like to perform.

When you start profiling, you will be able to see some runtime information including a graph showing profiled and system memory, and a list of classes. You will want to exercise your application, while memory information is being collected in the background. You can click View Temporary Objects when you observe a system garbage collection in the Session Control window, click Force Garbage Collection and then click View Temporary Objects, or you can quit your application that will force a garbage collection and create a session file.

You can focus on specific areas of your application by clicking Clear All Memory, to empty the data collected up to that point, exercise your application and then create a session file. This lets you see temporary object usage for a smaller section of your application, for example an area that you may be having issues with.

When you finish profiling, Memory Analysis will take a snapshot of the managed heap and display the data in a session file.

Temporary Objects



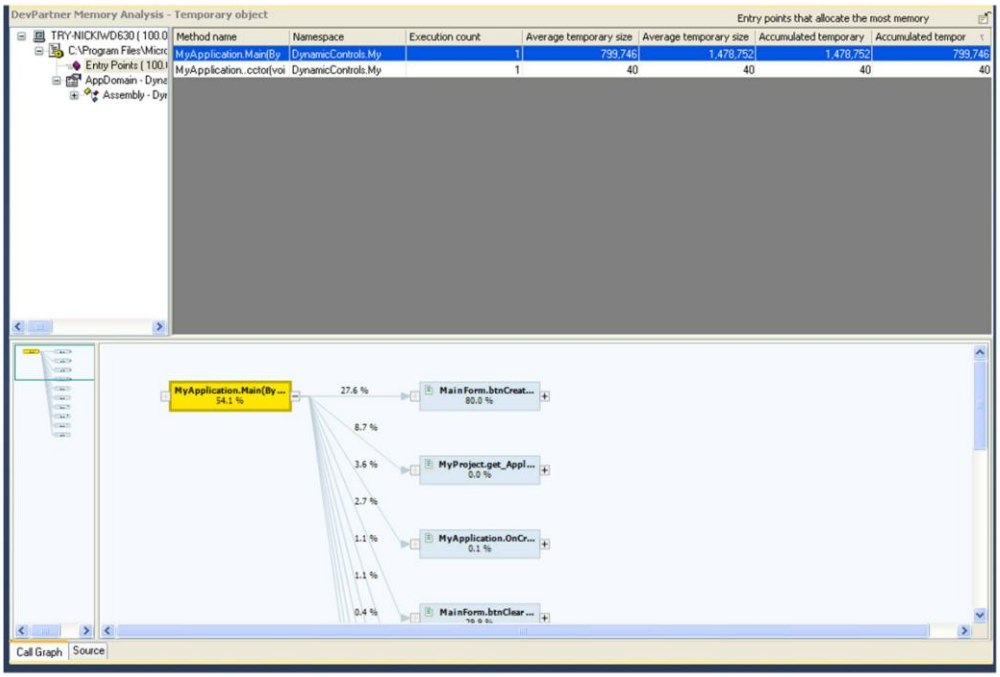
Once you've completed running Memory Analysis, you will have a session file. The summary page highlights the areas that allocate the most temporary space. The summary includes two graphs.

The entry points that allocate the most memory will show the entry points that allocated the most temporary space since tracking started (either the application started or the last time data was cleared). This includes temporary space used by the child methods that the entry points called. An entry point is a method that is being profiled that is called from excluded (system) code.

The graph showing methods that use the most memory will show the methods that allocated the most temporary space since the tracking began.

You can drill down into the details for each area by clicking on Show Complete Details.

Temporary Objects

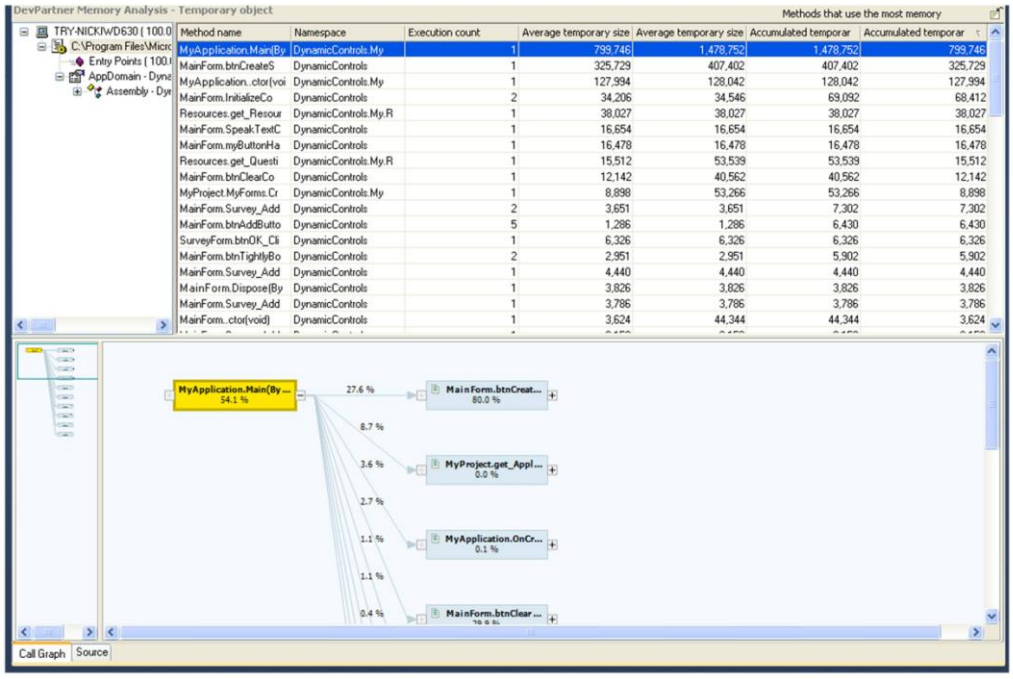


The details for entry points that allocate the most memory will show you a list of all user-code entry points in the session file. Entry points are methods, so this is a method list. Organizing data by entry points will present the methods in the context in which they are used. This will focus on methods that are invoked when your application starts, or otherwise called by system code.

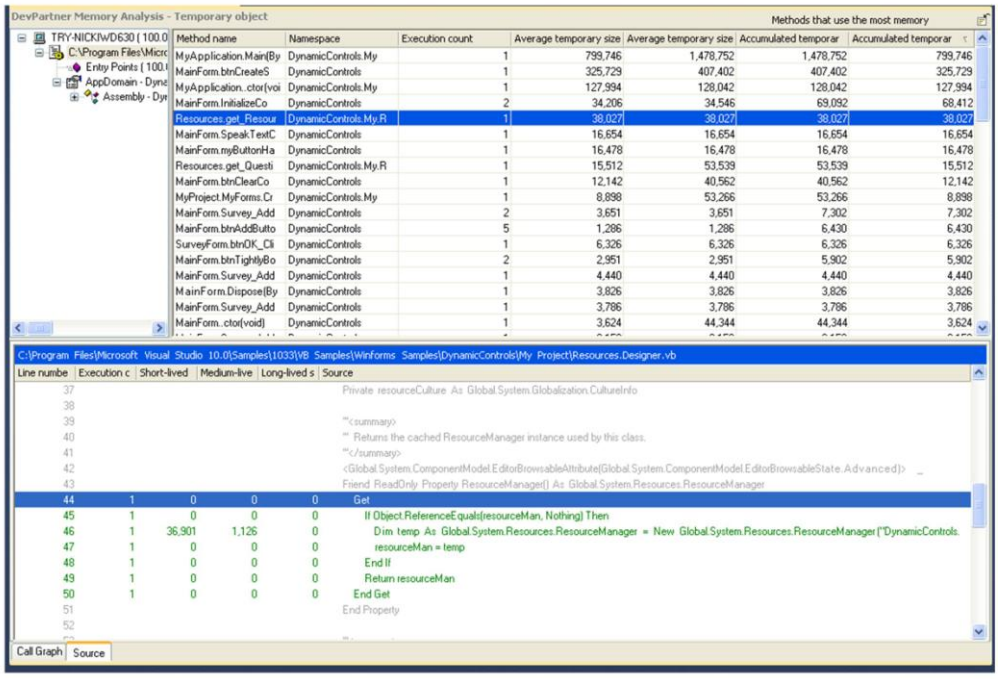
By default, this is sorted by the Average temporary size including children. This will show the average of the short and medium lived memory used by this method and its child methods. You can customize this display by right clicking and choosing Choose Columns to show the data that is important to you. If you want to see all the data without needed to edit the display, when you select a method the information will be displayed in the Visual Studio Properties window.

When you select a method from the list, the call graph will show the sequence of method calls with that method as the base node. You can also switch to the source tab to view the source code for your application.

Temporary Objects



Temporary Objects



You can view the source code tab to see line level information for each method of your application. You can easily see the number of times the line was executed, and the size of short, medium and long lived objects. This lets you pinpoint areas of your application that could be edited to improve memory usage.

Module Exercise

Please turn to your Exercise Guide and complete

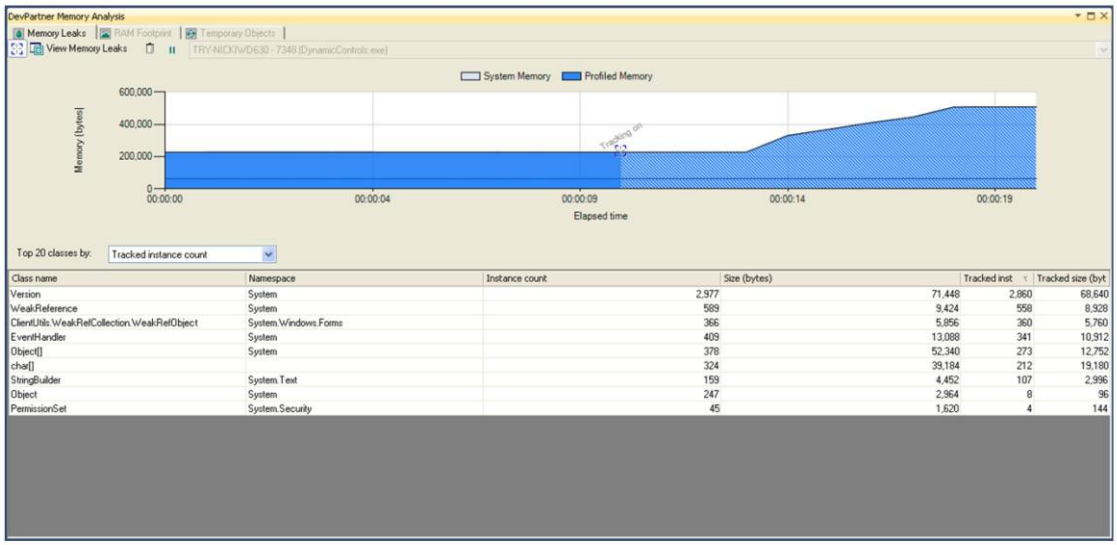
06_DevPartnerStudioMemoryAnalysis-EG: Exercise 2

Memory Leaks

- DevPartner Studio defines a leaked object as an object that was allocated and not garbage collected during some point in time.
- It would be impossible to DevPartner to determine if the object was “forgotten” or is being kept alive for future use.

DevPartner Studio defines a leaked object as an object that was allocated after time A, but that has not been gathered by the garbage collector by the later time B. Determining time A is straightforward in most cases; object allocation is either explicit, or is the result of some method call or operation. Determining time B is less straightforward, mainly because object de-allocation is not explicit in .NET. It is virtually impossible for DevPartner to deduce whether a given object has been "forgotten" by an application, or is simply being kept alive for future use.

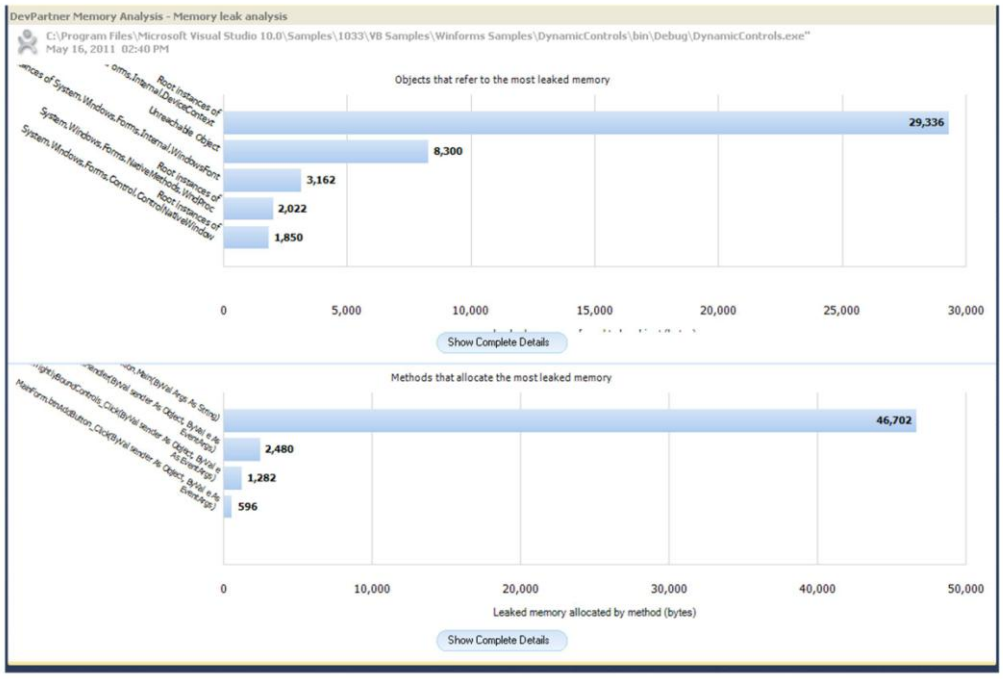
Memory Leaks



To gather memory leak information about your application, start your application with Memory Profiling. You can choose the DevPartner->Start without Debugging with Memory Analysis menu option. This will enable profiling for all three different analysis type. You choose the tab that is appropriate for the analysis you'd like to perform.

Exercise the relevant feature of your program once to force any lazy initialization to complete. Once you've done this, click on the start/stop button (on the far left) to begin tracking newly allocated objects as potential leaks. Walk through your application, exercising the features that you want to test for heap growth. Click on force garbage collection, and you can see the tracked instance count and tracked size in the class list for objects that do not get freed as you expect. You can click the start/stop button again to stop tracking. Walk through the same features of your application to clear the results of the previous run, and force garbage collection. If you see objects that have been allocated by not collected, click on View Memory Leaks to capture a view of the managed heap that will show the tracked objects that remain after garbage collection.

Memory Leaks

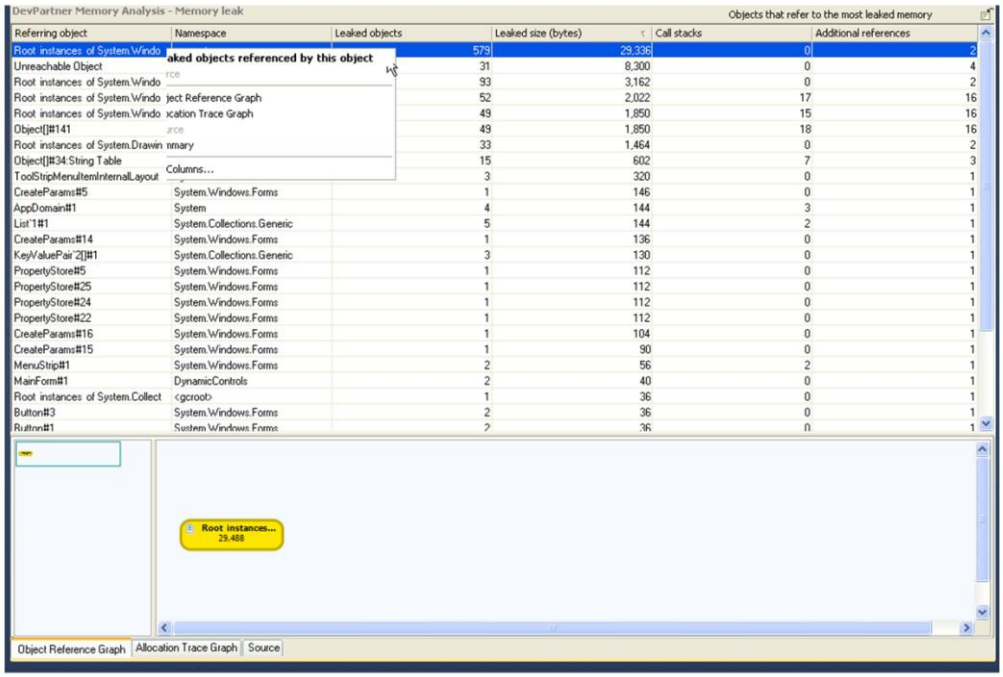


The Memory Leak summary will give you high level information on the leaked objects found by DevPartner Memory Analysis.

The Objects that refer to the most leaked memory graph will show the top five objects that leaked memory during the time you tracked memory allocations, and were still alive when the session file was created. The size will include memory leaked by child objects referenced by the leaked objects. This lets you see the objects most responsible for leaked memory. The easiest way to clear a memory leak is to go to each of these objects and set the appropriate reference to null if possible in your application.

The Methods that allocate the most leaked memory will show you the methods that allocated the most leaked memory during the time you were tracking. This will include the amount of memory leaked by this method and any non-profiled children.

Memory Leaks

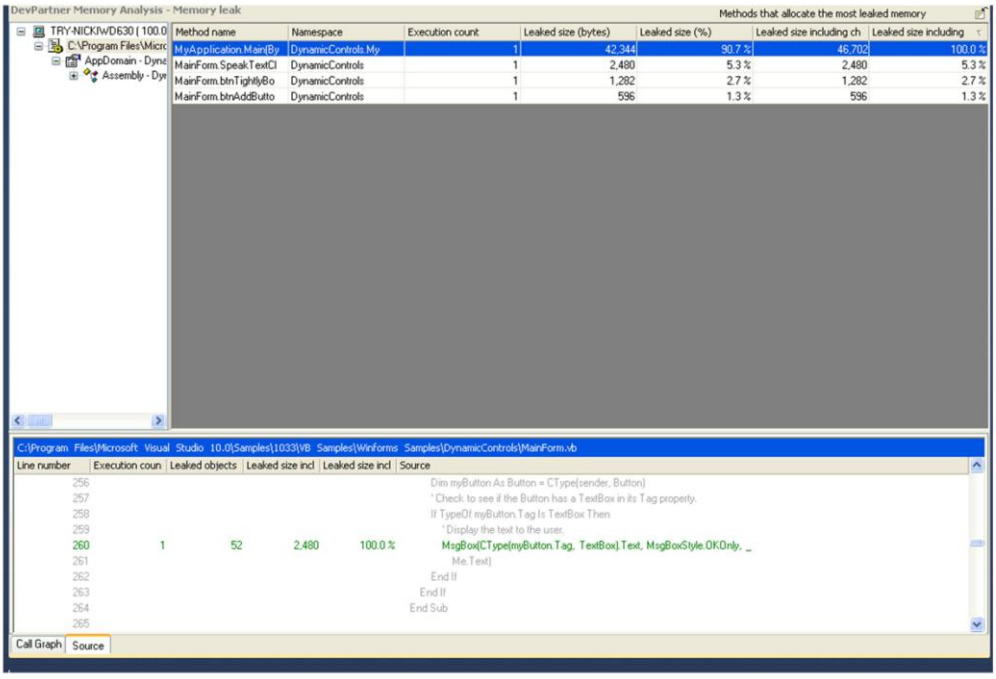


You can drill into the list of objects that refer to the most leaked memory to display a list of objects that held references to leaked objects in memory when the session file was created. This can help you focus on objects whose members you would have to change to eliminate memory leaks. You can drill down to view all the leaked objects to which an object refers by double clicking or right clicking and choosing the leaked objects referenced by this object. You can continue to drill down the chain of referenced objects in this way.

At any point, you can look at the Object Reference Graph, to see the sequence of references that keep objects in memory. This can show you why an object has not been collected by garbage collection.

You can also drill into the Allocation Trace Graph to show the method calls that allocated the selected object, or select the source tab to view the source code for the methods that allocated the selected referrer.

Memory Leaks



Module Exercise

Please turn to your Exercise Guide and complete

06_DevPartnerStudioMemoryAnalysis-EG: Exercise 3

Error Detection

Objectives

- Explain why you would use Error Detection
- Understand the types of problems Error Detection can find
- Run Error Detection and analyze the results

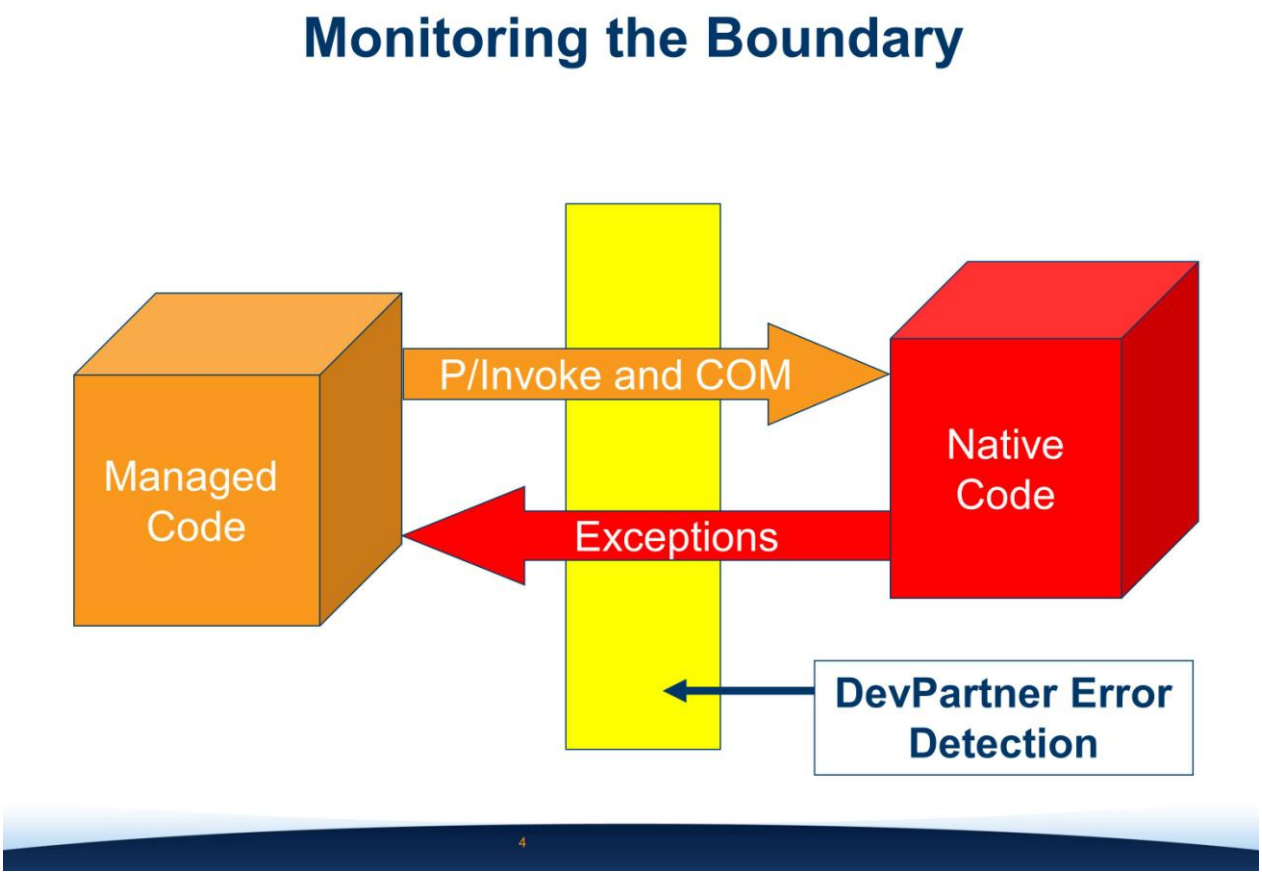
By the end of this module, you should understand why you would use Error Detection, the types of problems that Error Detection can find, and be able to run Error Detection and analyze the results.

What is Error Detection?

- An automated error detection tool for native (unmanaged) C and C++ applications
- Helps to quickly find
  - Memory Leaks
  - Resource Leaks
  - Memory Errors
  - Pointer Problems
  - Thread deadlocks
  - API/COM call problems
- Two types of analysis
  - Active Check
  - Final Check

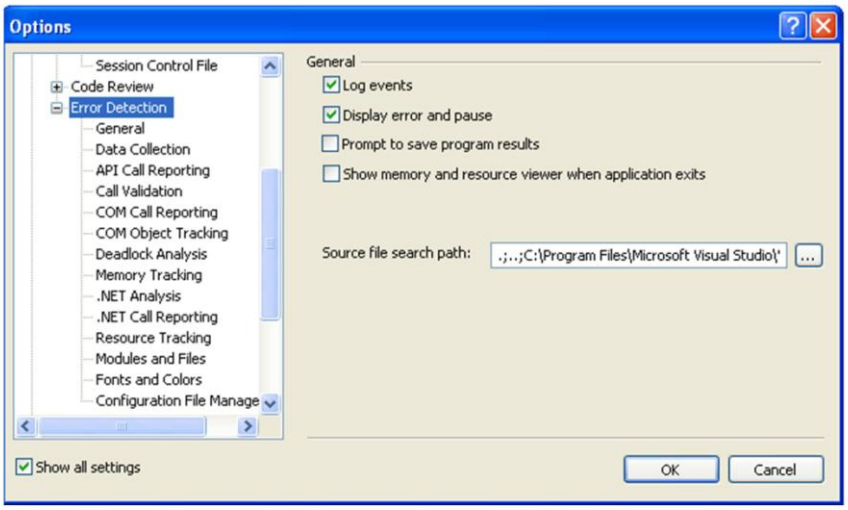
Error Detection is powered by BoundsChecker technology to provide detailed analysis of programming errors in your C and C++ applications. It detects and diagnoses errors in static, stack, and heap memory. DevPartner Error Detection also detects memory and resource leaks, COM interface leaks, and it can monitor the boundary between managed and native code.

Error Detection uses *ActiveCheck* technology in its sessions. ActiveCheck reports API validation errors at run-time, reports memory and resource leaks when a program terminates, and isolates errors to the line where the memory or resource was allocated or the error was generated. Error Detection also uses the patented *FinalCheck* technology to instrument Visual C or Visual C++ applications. With FinalCheck, error detection can pinpoint errors to the exact statement where they occurred.



BoundsChecker sits between native and managed code and monitors P/Invoke and COM interoperability calls from managed to native code. BoundsChecker also monitors unhandled exceptions passed from native code to managed code.

Error Detection Configuration



Before you run Error Detection against your application, you will want to configure the options to detect and look for the problems you would like to track down in your application. This can help to minimize “false positives”, or those items that you are not concerned about at different stages in your application lifecycle. You can save your settings as a Configuration File that can be loaded and reused over time.

You can access these options from the DevPartner->Options menu item.

Error detection options are broken down into different categories:

General – Determine if you are going to log events during the run of your application, if different windows pop up during execution and settings for saving results.

Data Collection – Set the level of data collection, for example the call stack depth.

API Call Reporting – Enable the ability to record calls your application makes to system functions, their parameters and return values. Limiting the data collection can help to improve performance during an Error Detection session.

Call Validation – Choose to monitor calls from your application to the operating system libraries and COM method calls. Error Detection will attempt to validate the parameters passed and if the call returned a success value.

COM Call Reporting – Record calls to COM interfaces as well as the returns. Error Detection will record parameter values and the returned HRESULT. To improve the performance of your application running with Error Detection, you can select only those interfaces you need to check.

COM Object Tracking – Monitor your program for leaked COM objects. To help improve performance, select a subset of All COM classes.

Deadlock Analysis – Monitor multi-threaded applications for deadlocks. This includes monitoring and reporting of deadlocks as they occur in the application and monitoring the usage patterns of the synchronization objects within your application for potential deadlocks.

Memory Tracking – When memory tracking is turned on, Error Detection will monitor all calls in your application that allocate and free memory, and will report on memory not freed at the end of the application. If your application was built with FinalCheck instrumentation, and FinalCheck is enabled, Error Detection will record instances where the last reference to an allocated block of memory goes out of scope and will report memory and pointer errors at the statement level during the run of your application (instead of at the end of the application).

.NET Analysis – Used when you develop applications that use a mix of unmanaged and managed code and unmanaged resources. .NET Analysis will analyze transitions between unmanaged and managed code for possible performance enhancement, monitor exceptions passed across the unmanaged to managed boundary, monitor garbage collection events, and analyze .NET finalizers for possible errors or leaks.

.NET Call Reporting – Record calls to .NET interfaces as well as the returns.

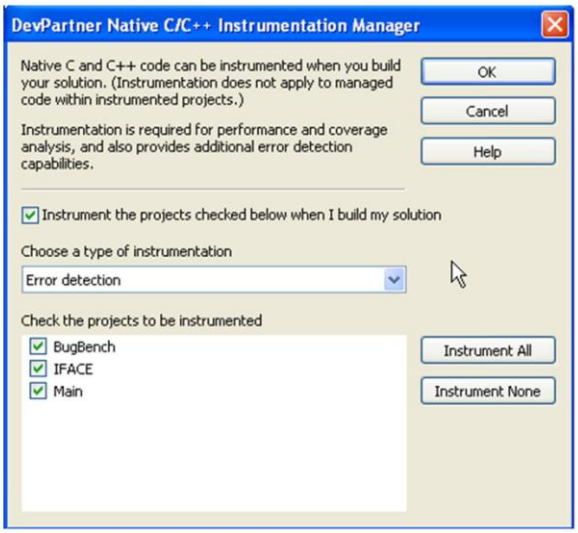
Resource Tracking – Monitor all calls in your application that allocate and free system resources other than memory, and report resources that have not been freed when your application ends.

Modules and Files – Select the modules and files to monitor during Error Detection, including the option to show only errors that appear in your code.

Fonts and Colors –Control the appearance of items in the Error Detection results file.

Configuration File Management – Save and load sets of options that have been saved as Configuration Files.

FinalCheck Instrumentation



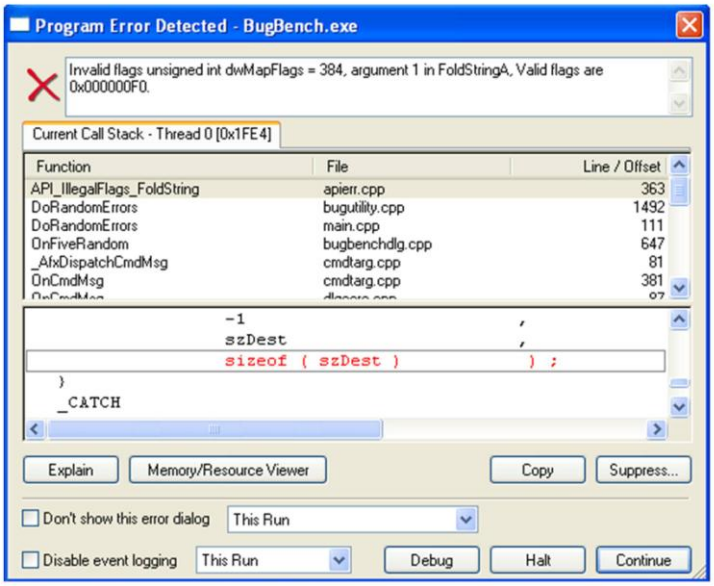
Error Detection has two modes of operation, ActiveCheck and FinalCheck. They are both able to detect errors in your applications, however FinalCheck is able to find more problems, and find some issues closer to the source. For example, in ActiveCheck you can get results referring to memory leaks at the end of your program. With Final Check, you can be reported memory leaks leaving scope, allowing you to see and be informed about these issues closer to the source.

In order to provide the additional details, FinalCheck does require instrumentation. This means your application will need to be built with Error Detection. To enable the instrumentation, you need to use the Instrumentation Manager. You can access this by choosing the DevPartner->Native C/C++ Instrumentation Manager. You will need to define the type of instrumentation to use. You can choose to instrument with Error Detection, or with Error Detection with coverage which will allow you to also see which lines of code were executed, and which ones were not, during the run of your Error Detection session. You will need to enable instrumentation by choosing DevPartner->Native C/C++ Instrumentation. You will also need to ensure that you have the option Enable FinalCheck selected. You can find this under the Memory Tracking options.

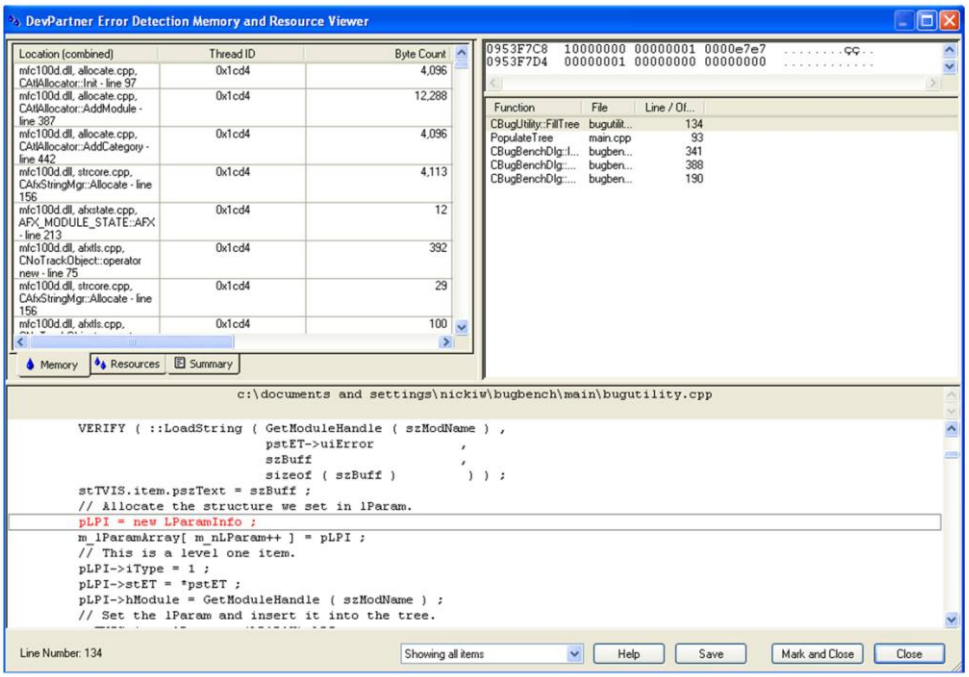
For solutions with multiple C/C++ projects, you can also choose which projects to instrument.

Once you've selected the projects to instrument and enabled instrumentation, rebuild your solution to add the FinalCheck instrumentation to your application.

Error Detection



Memory and Resource Viewer



You can access the Memory and Resource Viewer in a few ways. If you have an error detected, you can click on the button to launch the viewer. You can also select an option to open the viewer when your application session is complete. You can also use Memory and Resource Viewer APIs embedded in your application.

There are different tabs you can see the details of in the Memory and Resource Viewer.

The **Memory** tab will list memory that has been allocated but not yet freed. When you select an allocation, the corresponding details appear in the contents field, and source is displayed in the bottom pane. The Memory pane will have many columns, providing you additional information about each allocation. These columns are:

Grouped by - Appears if you select a Group by method for displaying results in the Memory tab. You can group results by Allocating Function, File, or Mark Sequence.

Allocating Function - Lists the function that allocated the memory, if known.

Thread ID - Identifies the thread that allocated the memory.

Byte Count - Size of the memory allocation

Grouped by - Appears after you select a grouping category. Displays the current grouping category.

Address - Address of the memory block.

File - Names the file that contains the function that allocated the memory.

Line/Offset - The line number within your file where the allocation was made. If symbol information is not available, the hex offset is given instead.

Mark Sequence - Indicates whether the memory was allocated before or after the most recent mark set with the Memory and Resource Viewer dialog box.

Index - Relative allocation index. Provides information about where, during the application run, the memory was allocated

The **Resources** tab will list resources that have been allocated but not yet freed. All corresponding details for the resource will be populated when you select an item. The Resources pane will have many columns, providing you additional information about each allocation. These columns are:

Allocating Function - Lists the function that allocated the resource, if known.

Thread ID - Identifies the thread that allocated the resource.

Address - Address of the resource.

File - Names the file that contains the function that allocated the resource.

Line/Offset - The line number within your file where the allocation was made. If symbol information is not available, the hex offset is given instead.

Super-Type - A coarse method of categorizing the resource type.

Type - A more granular identification of the allocated resource.

Mark Sequence - Indicates whether the resource was allocated before or after the most recent mark set with the Memory and Resource Viewer dialog box.

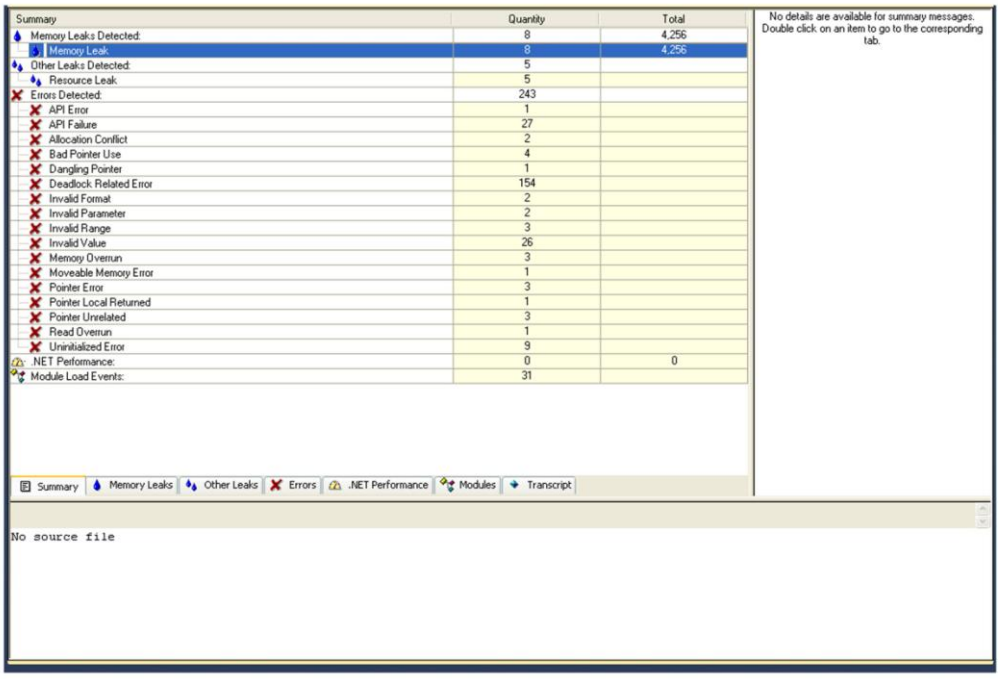
Index - Relative allocation index. Provides information about where, during the application run, the resource was allocated.

Address - Address of the allocated resource.

The **Summary** tab will show high level information about existing allocations. This includes the type of item being tracked, the number of allocations before and since the mark (which is set by clicking the Mark button), and the total number of resource and memory allocations counted.

You can save this information to a text file by clicking the Save button.

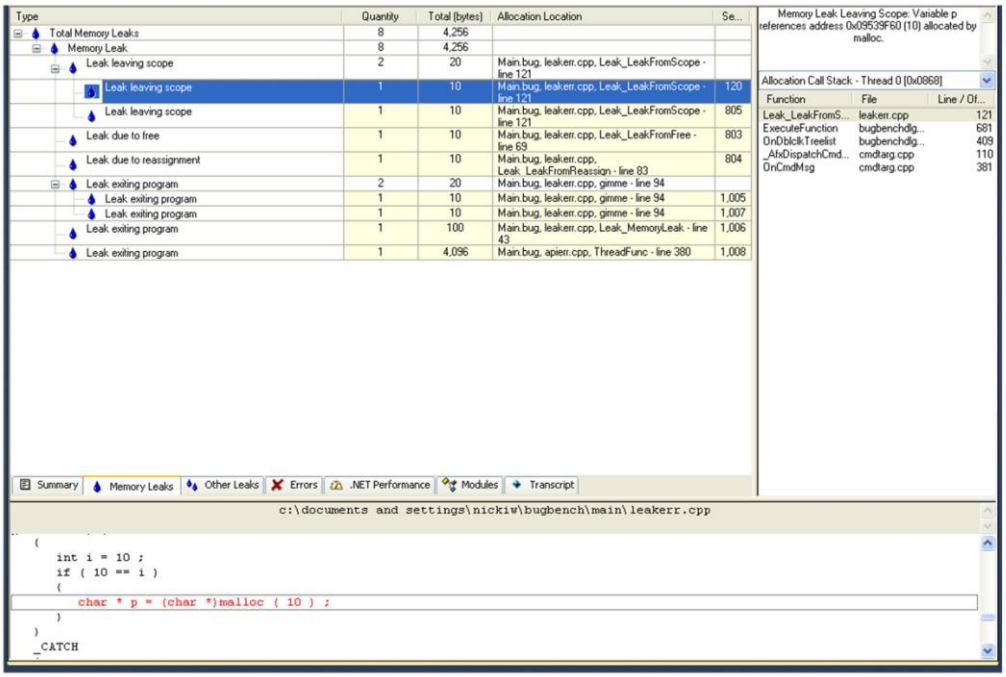
Error Detection



As you are running your application with Error Detection, a session file is being populated with the results. This session file has many tabs, in order to group similar information in one view.

The **Summary** tab will show you at a high level the types of errors that were found. You can drill down into the list of specific error types by double clicking on the category, or by selecting the appropriate tab across the bottom of the session file.

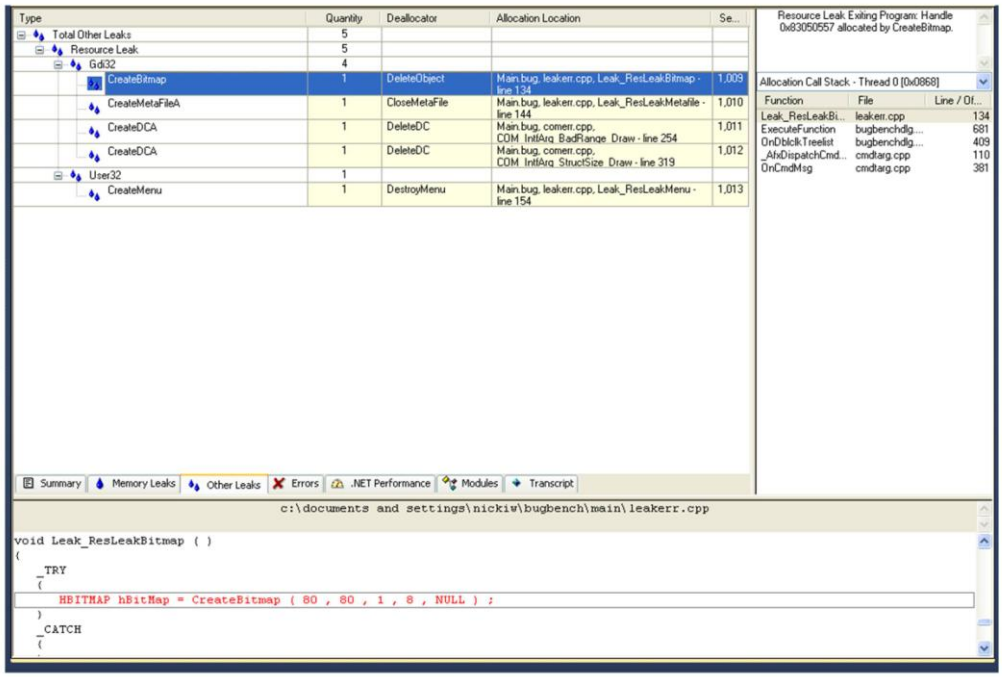
Error Detection



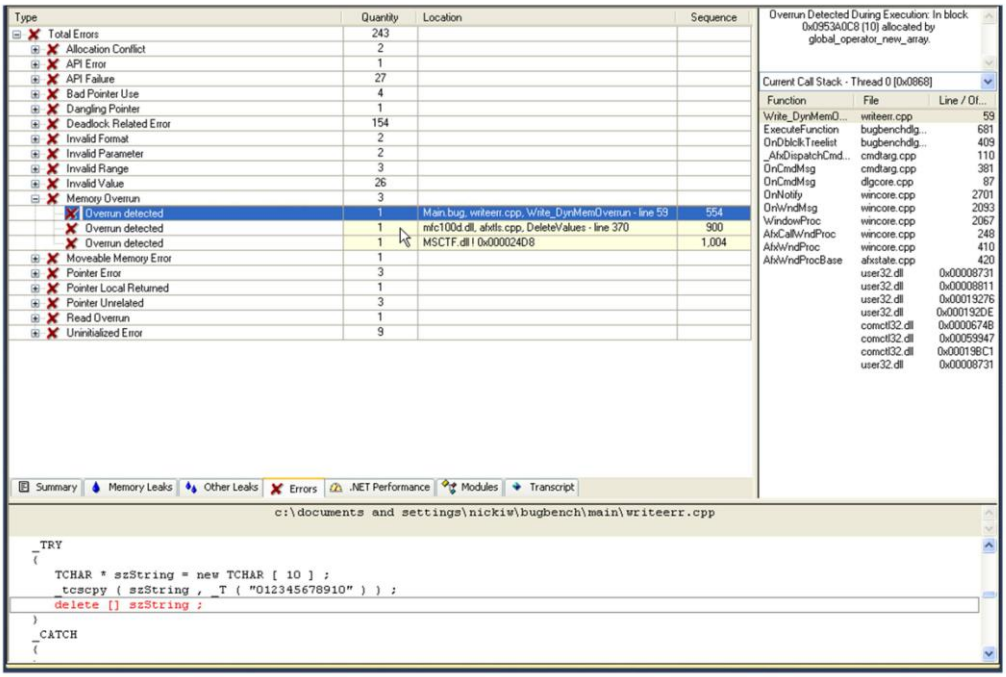
The **Memory Leaks** tab will show you details about all memory leaks found during the run of your application with Error Detection. If you are using ActiveCheck, all of your memory leaks will appear as Leak Exiting Program. If you are using FinalCheck, you can view more information about your memory leaks, such as pinpointing Leak leaving scope.

The memory leaks tab will show you the type of leak, the number of instances of each type, the size of the leak (in bytes), the location of the allocation, and the event sequence. When you select an instance of a leak, the details will be populated. This includes the description of the leak and call stacks. Depending on the leak type, you can choose to view one or many call stacks including the current call stack, the call stack at allocation, the call stack at deallocation, and the call stack at allocation of nested block. You will also be able to view associated source code in the bottom pane.

Error Detection



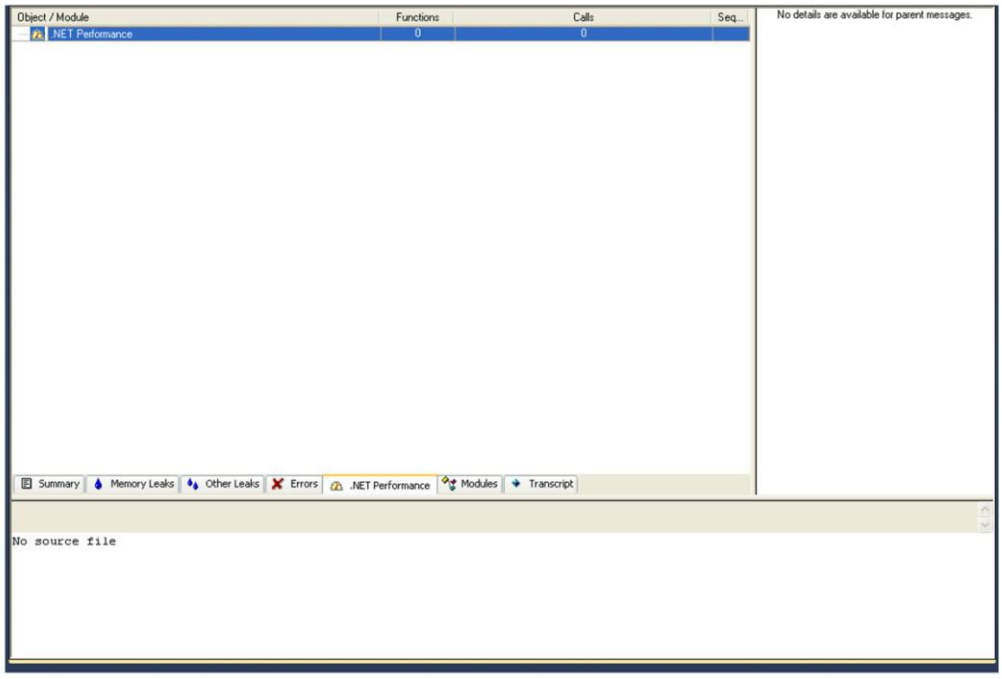
Error Detection



The **Errors** tab will display the errors that occurred in your application, such as API failures, invalid call usage, etc. You will see information on the type of error found, the number of instances of each error, the location of the error and the event sequence number.

Selecting any of the error instances, you will see the details including the error description, call stack and associated source code. You can right click on the error and choose to filter to temporarily hide it from the display. You can also right click and choose Explain. This will open the help files that will give you information about the error that was encountered.

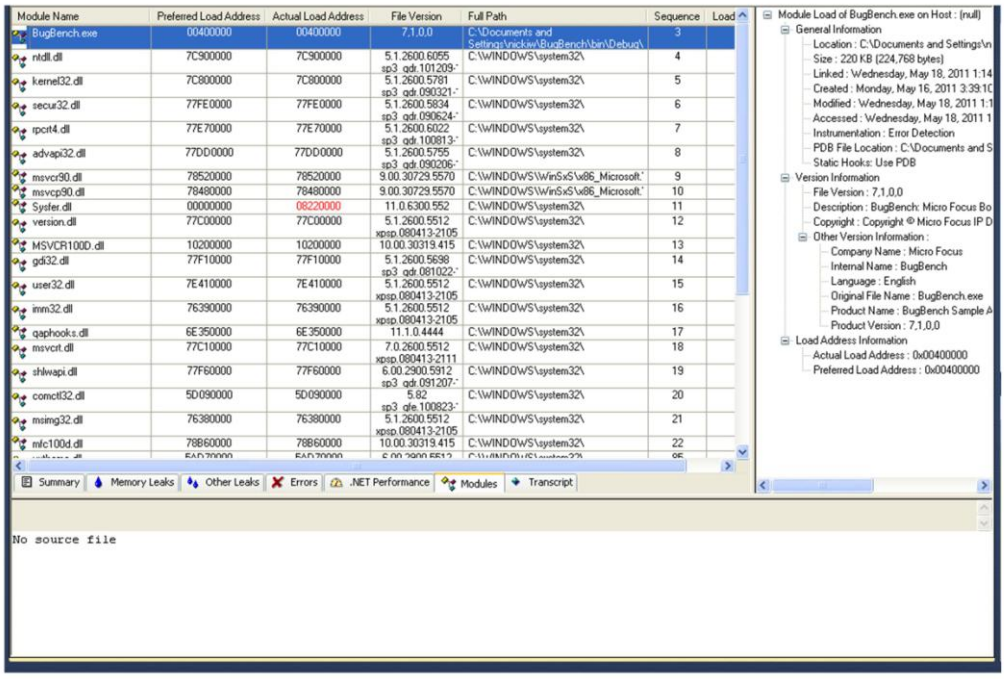
Error Detection



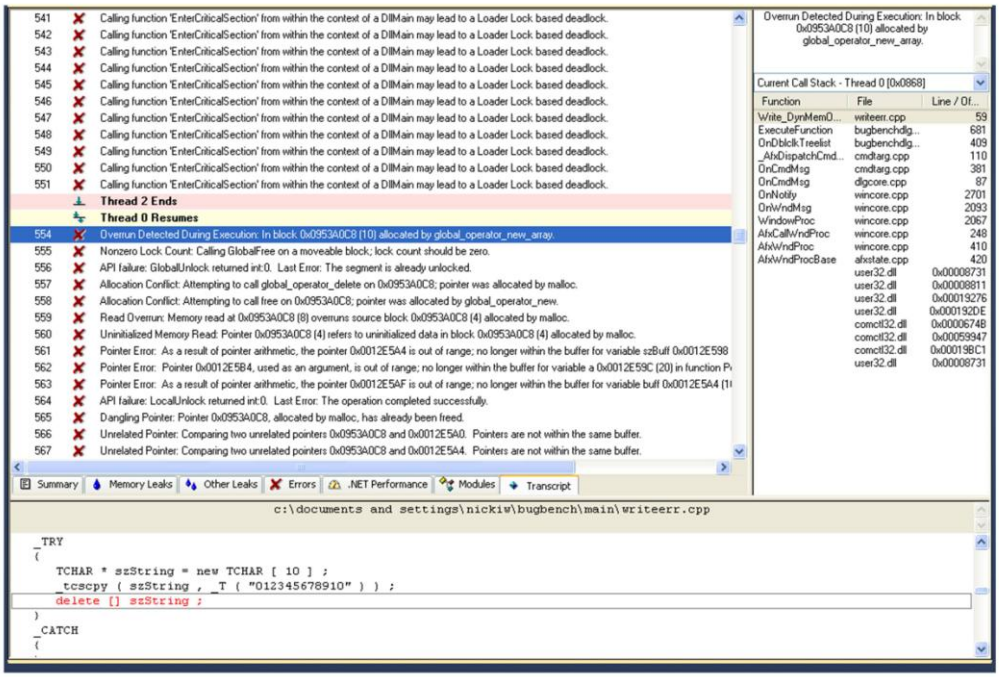
The **.NET Performance** tab provides information about the interaction between managed and unmanaged code in your application. Error Detection monitors the number of P/Invoke and COM method calls being made from managed to unmanaged code. You will see the name of the module called, the number of functions/methods (APIs) within the module that were called and the total number of calls for that module.

This information can help you isolate calls that are making frequent transitions, isolate chatty get or set method calls that might need to be replaced by new methods that process larger amounts of data and make fewer transitions, and locate code that might need to be ported to managed code for better performance.

Error Detection



Error Detection



The **Transcript** tab displays events and errors logged during an Error Detection run. The events are logged in order, letting you view the errors in context. If you right click on an error in the other tabs, you can choose to view that item in the transcript, which will take you to this tab, with the error highlighted.

Module Exercise

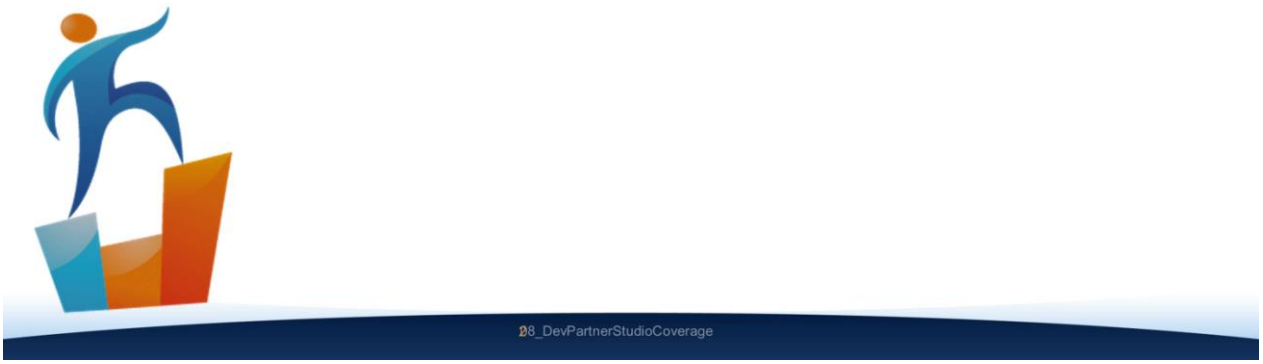
Please turn to your Exercise Guide and complete

07_DevPartnerStudioErrorDetection-EG: Exercise 1

Code Coverage

Objectives

- Explain why you would use Code Coverage
- Run Code Coverage and analyze the results



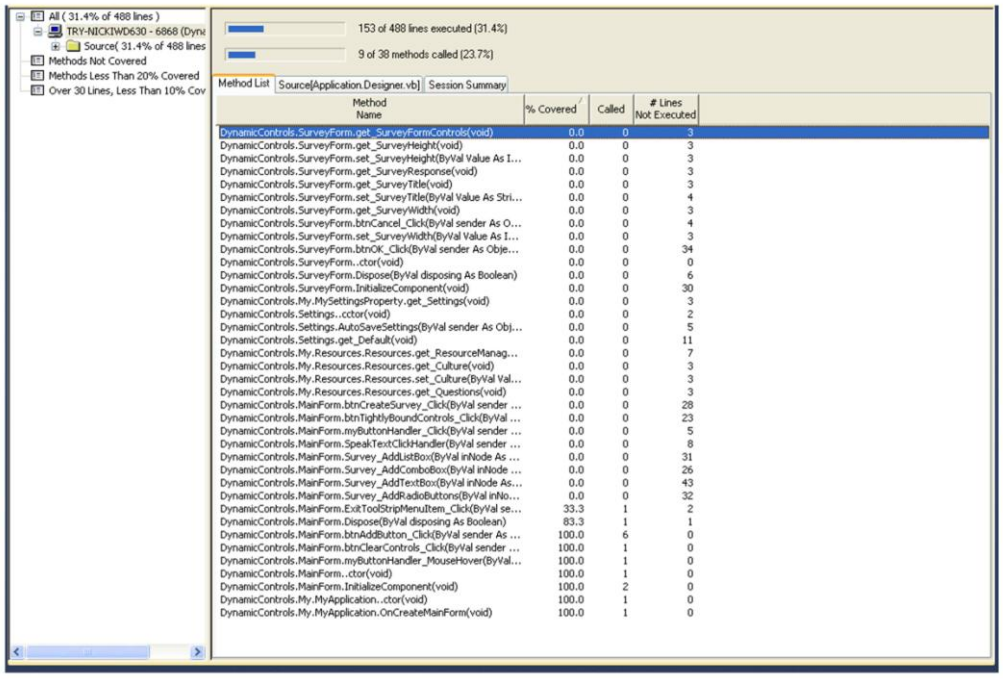
By the end of this module, you should be able to describe the purpose of using Code Coverage and be able to run and analyze coverage results.

What is Code Coverage?

- Used to located unexecuted code in your applications.
- Gathers coverage information for applications, components, methods, functions and individual lines of code.
- Works for .NET applications and C++ and VB6 applications or components.

Code Coverage is designed to give you a picture of the areas of your code that have not been tested or executed. You can view information at a high level, and drill down to lines of code that have and have not been executed. You can gather this information for your .NET and C++ or VB6 code. In the case of the unmanaged code, you will need to instrument your application to gather coverage information.

Code Coverage



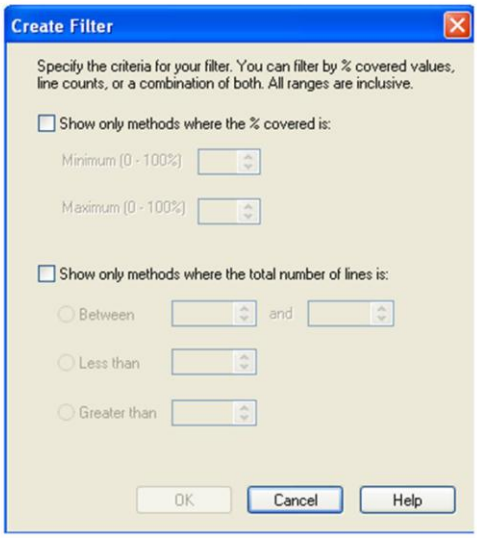
To run Code Coverage inside the Visual Studio IDE, choose the DevPartner->Start with Coverage Analysis menu item. This will start your application with Code Coverage collecting information in the background.

You can use the recording controls to take snapshots, or view results at certain times in the run of your application. When you stop Coverage analysis or exit your application, a session file will be created.

The first thing you see in your Code Coverage results is two different panes. On the left hand side, you can see a break down of your application and code coverage. You can also see filters, and create your own by right-clicking and choosing Create Coverage Filter.

The rest of the session file is a panel with a few tabs. The number of tabs will depend on the type of session file (a merged or combined file will have an additional tab). You can see high level information such as the lines executed and methods called. Below that information you can see a list of methods in your application and coverage details.

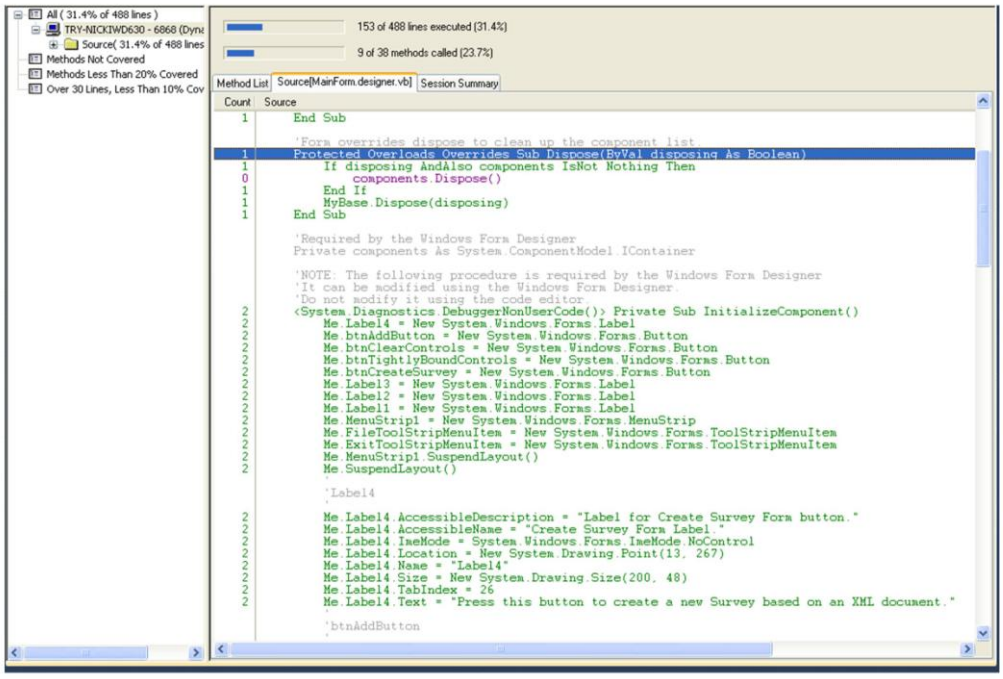
Code Coverage Filters



08_DevPartnerStudioCoverage

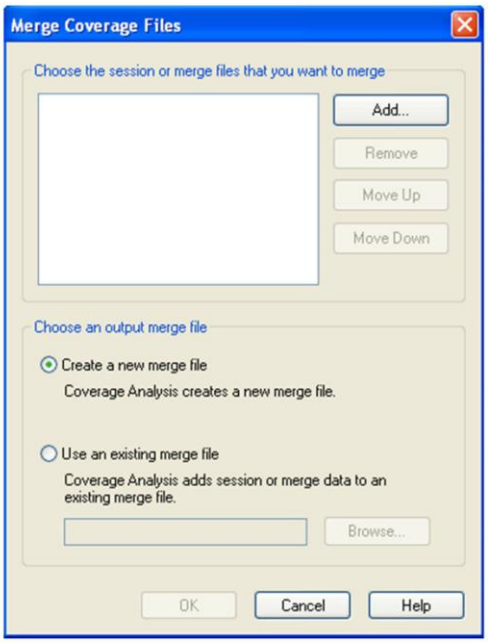
To be able to quickly view the information that is important to you, you are able to create your own coverage filters. You can create a filter to show you only methods with a range of coverage percentage (for example, show you only methods that have between 50%-75% coverage). You can also focus on methods with a specific number of lines, or range of lines.

Code Coverage Source View



You can drill down into the line details for your source code by clicking on the Source tab, or by right-clicking on a method and choosing Go to Method Source. You can see your source code in different colors to indicate whether the line was executed, not executed or unexecutable (for example, comments in your code do not count against your % of code coverage). This information can help you to determine the risk in releasing your application and help you when creating additional test cases for your application. In this example, green is executed, purple is not executed, and gray is unexecutable. You can change the colors used under the Visual Studio Options by selecting Environment->Fonts and Colors. When you select DevPartner Analysis from the Show Settings For drop down, you can change the color values.

Code Coverage Merge



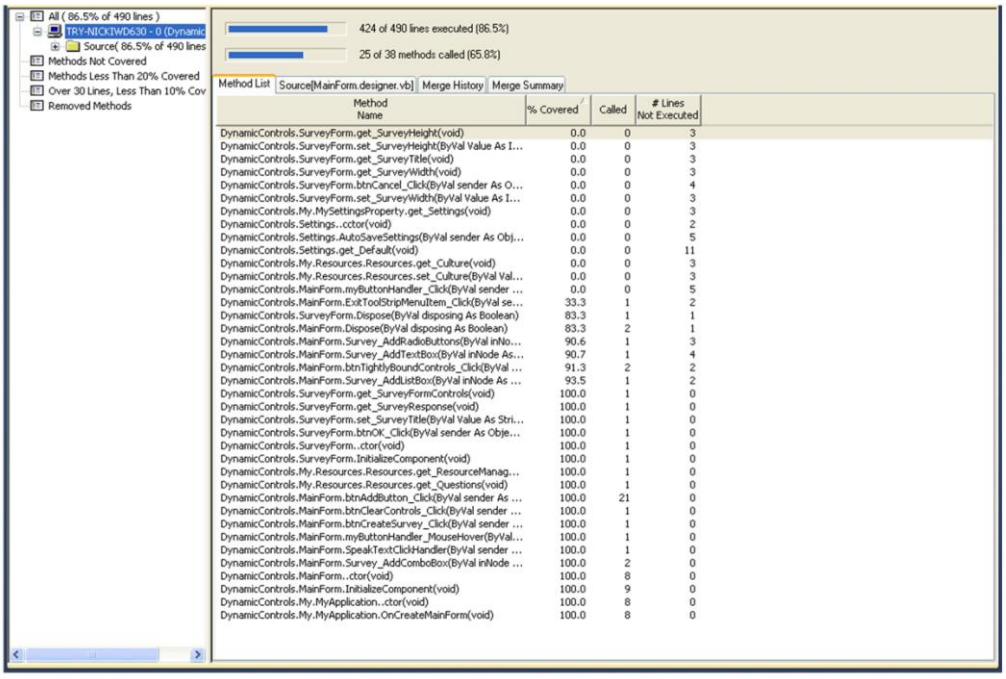
08_DevPartnerStudioCoverage

We walked through a session file generated by one run through an application. In most cases, you will run multiple tests against your application, and will have multiple people executing different areas of your application. In those cases, a single session file isn't going to provide a complete picture of the code coverage % of your application. To help with that view, you can choose to merge coverage files, or combine multiple sessions or runs in one view.

You can create a merge file by choosing the DevPartner->Merge Coverage Files menu item. You can then select the files to be included in the merge, and either create a new file or add these to an existing merge file.

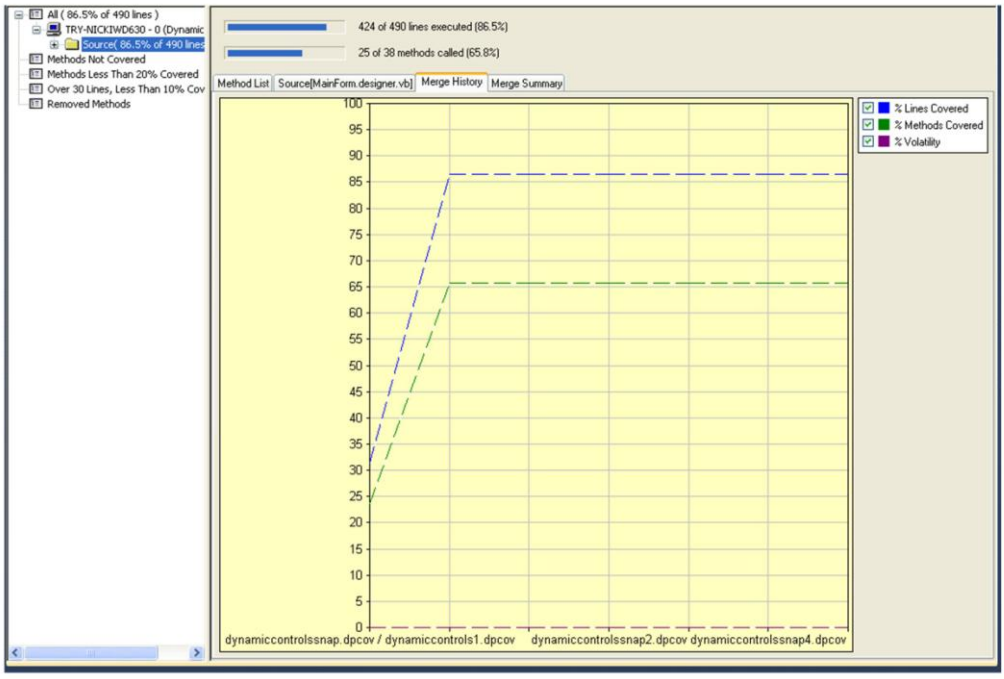
You can also set a property to automatically create a merge file for your sessions with that solution. In the Solution Explorer, select the current solution. There is a property called Automatically Merge Session Files. You can choose to be asked if you want to merge, do not merge, or automatically add the session results to the merge file.

Code Coverage Merge



Your merged results will look very similar to a session file for one run. The % results will be for a combination of all the single session files, there will be a filter to view removed methods (methods that were in session files at one point, but have been removed as coverage progressed), and an additional tab called Merge History.

Code Coverage Merge History



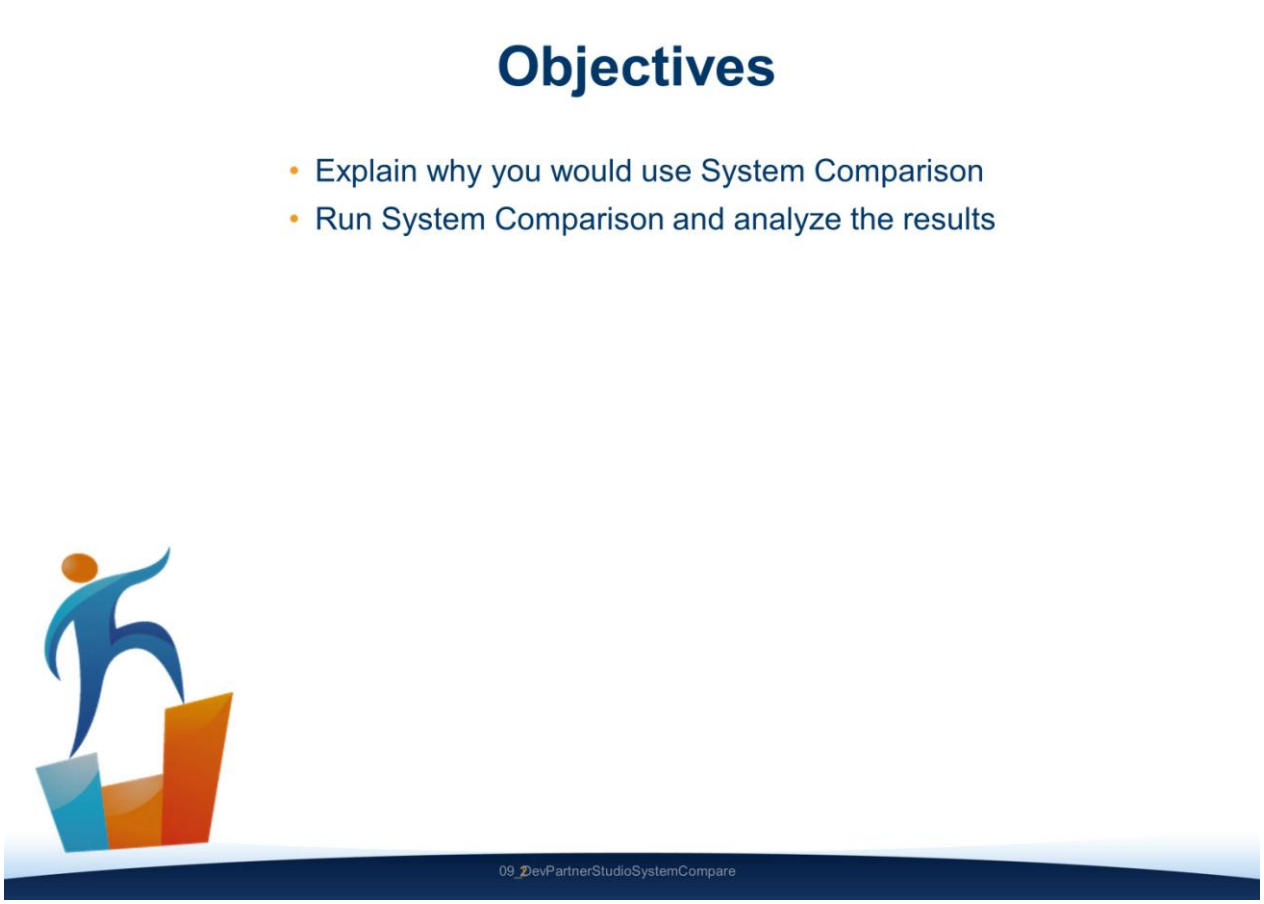
The Merge History tab will show a graph of how coverage has increased, decreased, or stayed the same as you've added additional files. Code Coverage also tracks Volatility, or the % of your application that has changed over time. This lets you see if your application is undergoing a lot of change, that could affect the coverage.

Module Exercise

Please turn to your Exercise Guide and complete

08_DevPartnerStudioCoverage-EG: Exercise 1

System Comparison



By the end of this module, you should understand why you would use System Comparison and be able to run System Comparison and analyze the results.

What is System Comparison?

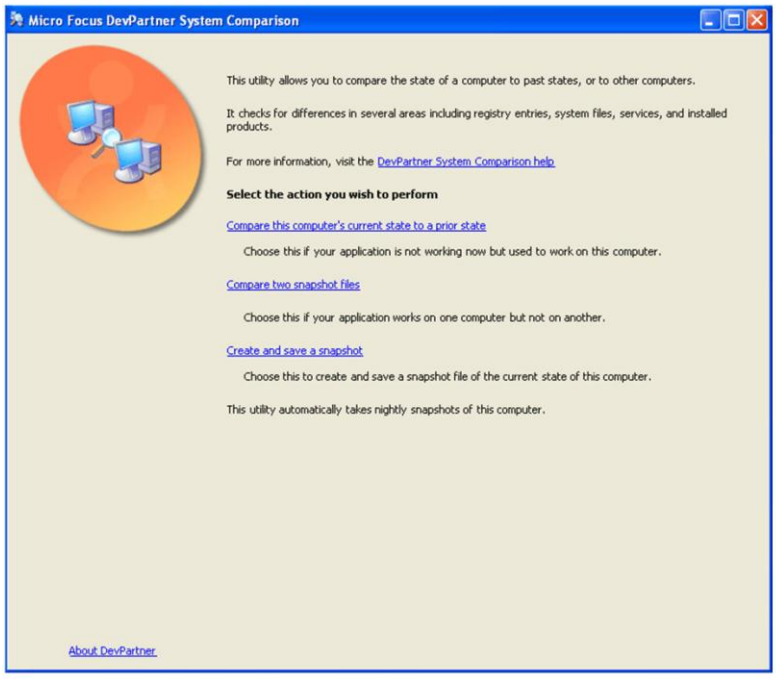
- Helps to answer the tough questions of:
  - Why does an application work on one machine, but not another?
  - Why did the application work yesterday, but not today?
- Captures system and application configuration information.
- Compares configuration information and identifies differences.

System Comparison helps you track down the answer to a couple of tricky questions: why does it work on one machine, but not another or why did it work yesterday but not today?

System Comparison will take a snapshot of a system at a point in time, and you can compare either 2 different machines or a machine at 2 different times, and be presented with the differences.

System Comparison is run standalone (not integrated in the Visual Studio IDE), and you can launch it from Start->All Programs->Micro Focus->DevPartner Studio System Comparison->System Comparison.

System Comparison

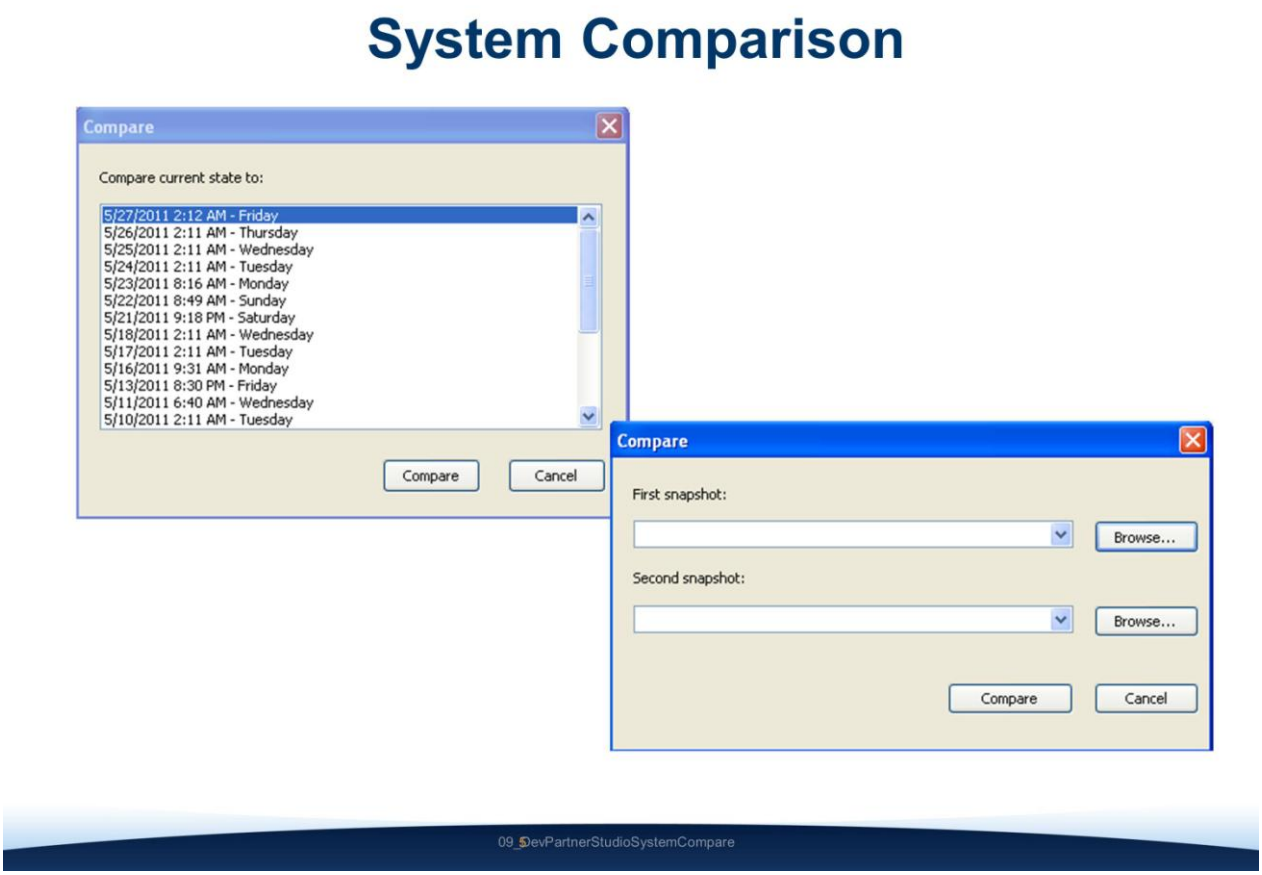


09_DevPartnerStudioSystemCompare

There are a few options when you choose to run System Comparison. You can choose to compare the state of the computer you are working on to a prior state. This will let you choose a previous snapshot to compare to the current state of the computer.

You can compare two snapshot files. This lets you compare snapshots that were taken on two different machines.

The last option is to take a snapshot of the machine and save it. You may want to take a snapshot before making changes to your machine (for example, before installing software). System Comparison automatically takes a snapshot of your machine. The default snapshot time is 2:10 am if the machine is running, otherwise it will take the snapshot 5 minutes after the next computer start-up. This service will collect 21 snapshots and then begin deleting the oldest ones. You can change the default values by changing the values in the settings file (MicroFocus.Diff.Settings.xml).

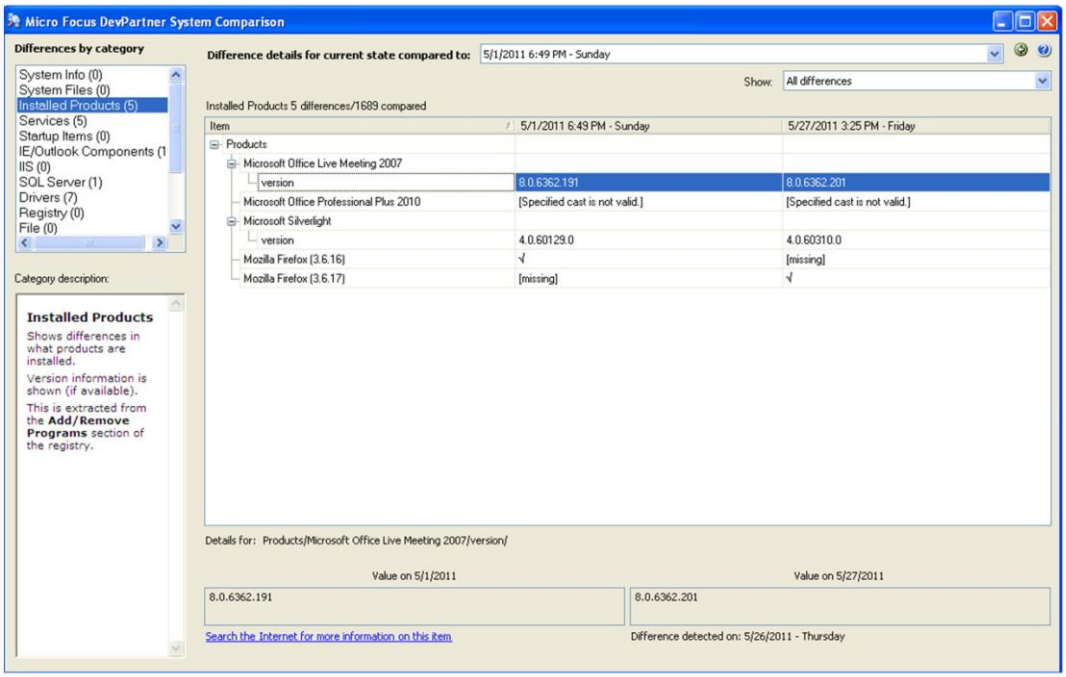


When you choose to run a System Comparison, you'll need to define the sources of the comparison.

If you choose to compare the computer's current state to a previous state, you will be prompted with the list of snapshots that were generated by the snapshot utility. System Comparison will then take a snapshot of your machine now and compare it to the values that were saved.

If you choose to compare two snapshots, you will need to browse to the locations of the two snapshots.

System Comparison



When the comparison has run, you will be presented with a list of differences. These are broken down into categories which are available on the top left of the screen. You can add additional categories by writing your own plug ins. When you select a category from the left, the main screen will be populated with the details of all the differences found. If you select a difference, you will see details below including an option to search for information online.

The categories of comparison are:

System Info – will detect differences with the Operating system, .NET Framework, Global Assembly Cache, Java Runtime, System Environment variables and File system case sensitivity.

System Files – differences in OS files in \\System32 and \\SysWOW64, Windows Files Protection Cache in \\System32\dllcache, and Side-by-side assemblies in \\WinSxs.

Installed Products – compares the products detected and the version number if it is available. This is read from the Add/Remove Programs section of the registry.

Services – detected differences in installed services (status, type, account used, start up type, etc.).

Startup Items – differences in startup items.

IE/Outlook Components – information about Internet Explorer and Outlook differences.

IIS – differences about the IIS installation including installed web applications and their settings.

SQL Server – data about your SQL server installation, not the data contained in the databases.

Drivers – the differences of installed drivers and their status.

Registry – differences in specific sections of the registry. By default, no registry sections are collected, but you can customize which sections of the registry to examine by editing the RegistrySections.xml file.

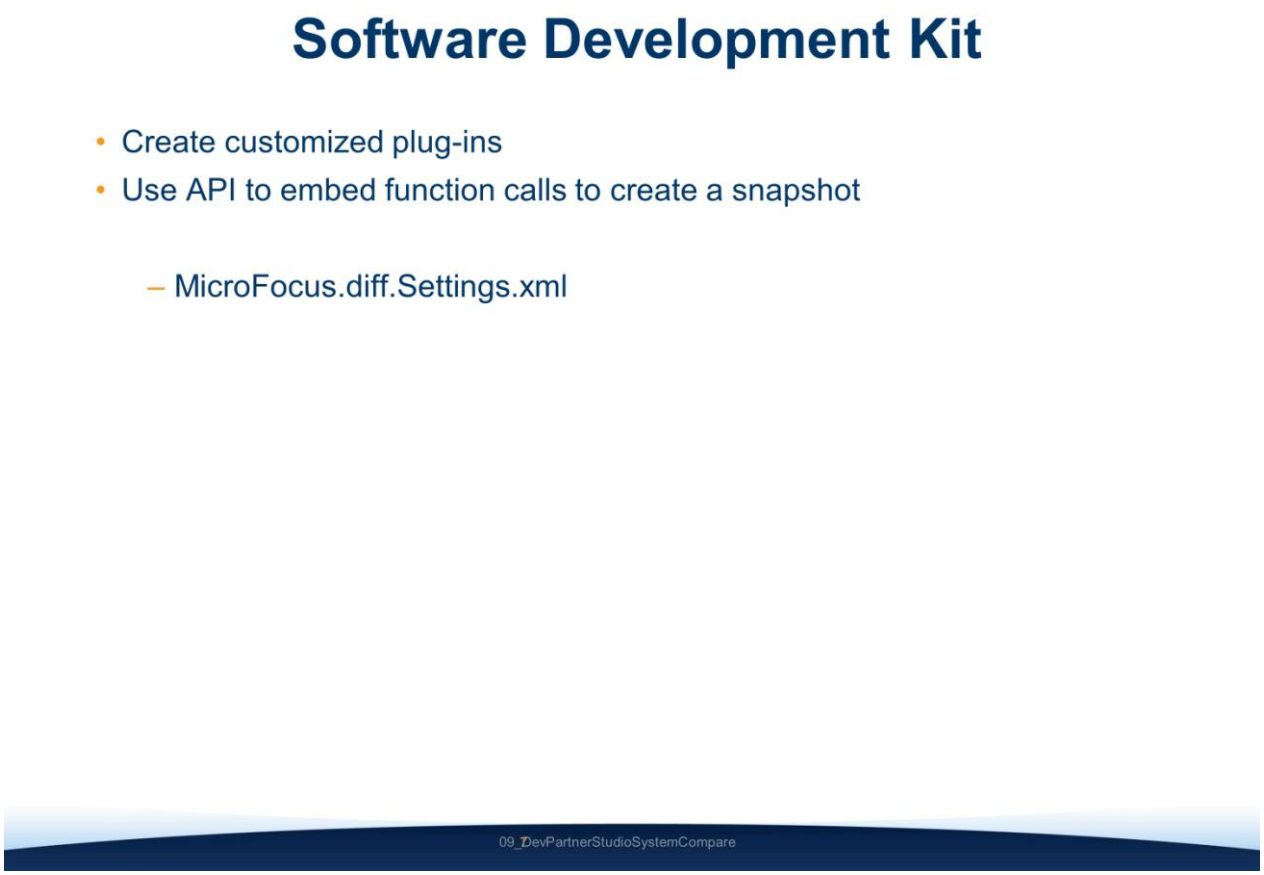
File – differences in the contents of directories and file properties from specific paths. By default, no files are included. You can customize which paths to examine by editing the FileSections.xml file.

.NET Security Policy – determines security policy differences.

Hardware – differences in system (model, number of processors, etc.), memory, and processor information.

User Environment – includes items like environment variables, accessibility settings and international settings.

Windows Update – difference on the stat of the Windows Update service.



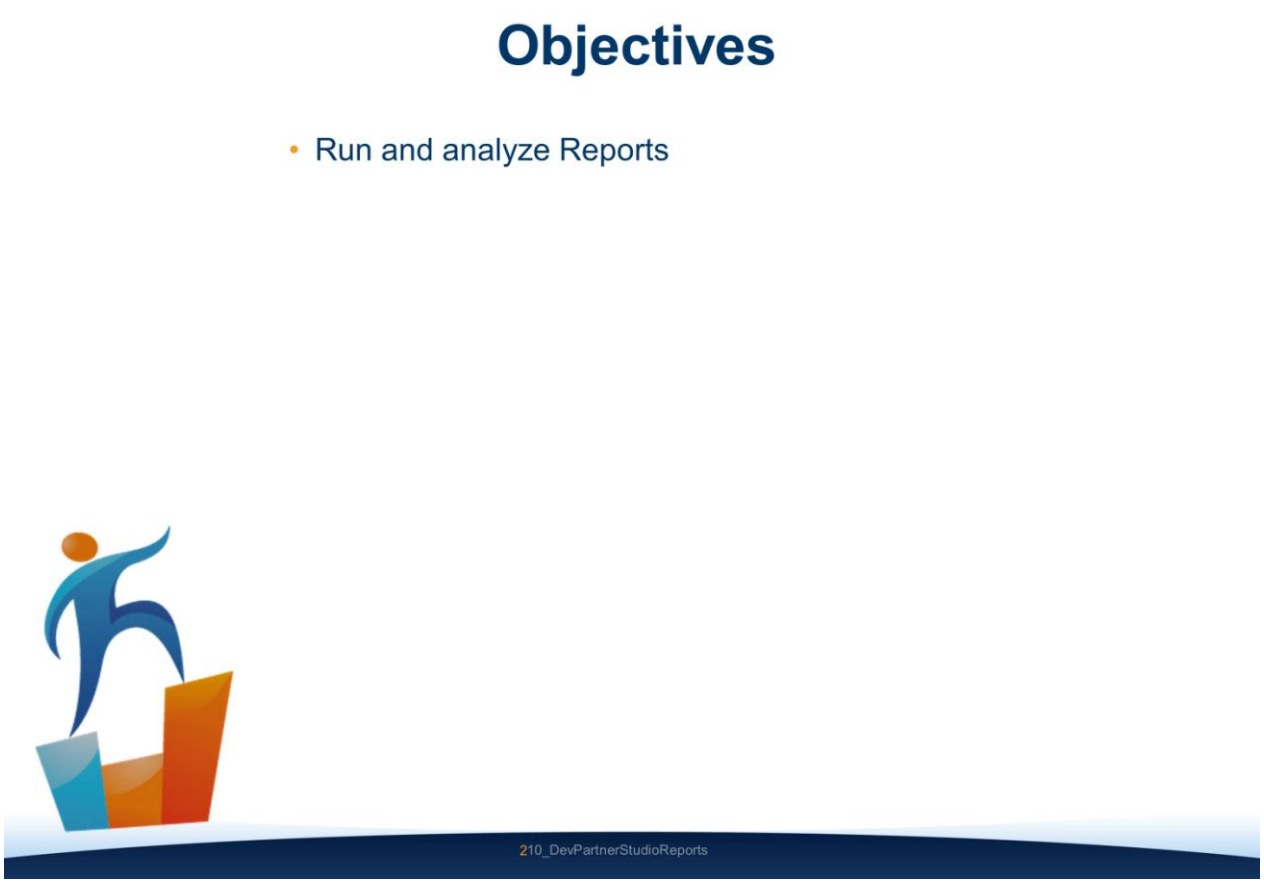
You can customize System Comparison using the Software Development Kit provided. This allows developers to build plug-ins to compare additional categories that aren't included with System Comparison. There is also a snapshot API provided that lets a developer control creating a snapshot from within a deployed application, meaning you can add the functionality to create a snapshot to your applications. You will still need to use the System Comparison interface to view the differences detected.

Module Exercise

Please turn to your Exercise Guide and complete

09_DevPartnerStudioSystemComparison-EG: Exercise 1

Reports



By the end of this module, you should be able to run and analyze reports containing DevPartner Studio result data.

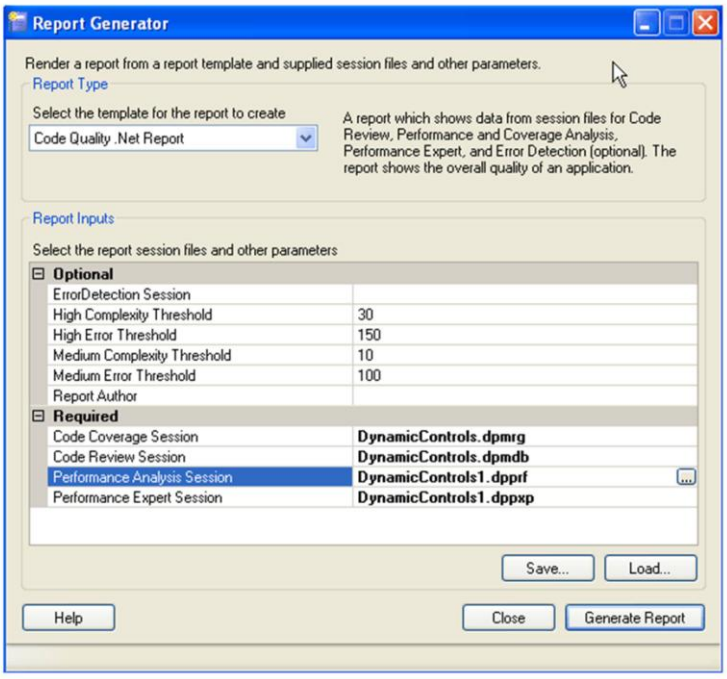
What are DevPartner Reports?

- Produces reports combining session data from DevPartner Studio 9.0 or later
  - Code Review
  - Error Detection
  - Performance Analysis
  - Coverage Analysis
  - Performance Expert

The DevPartner Reports utility is available to create reports based on the XML output from most of the DevPartner tools. You can create reports that use information from Code Review, Error Detection, Performance Analysis, Coverage Analysis and Performance Expert. Memory Analysis is not available for reporting, since it does not produce XML data from the session.

This allows you to create HTML reports based on DevPartner results that can be viewed outside of the Visual Studio IDE.

DevPartner Reports



410_DevPartnerStudioReports

To create a report based on DevPartner materials, you can launch the report utility from Start->All Programs->Micro Focus->DevPartner Studio->Prepare Report.

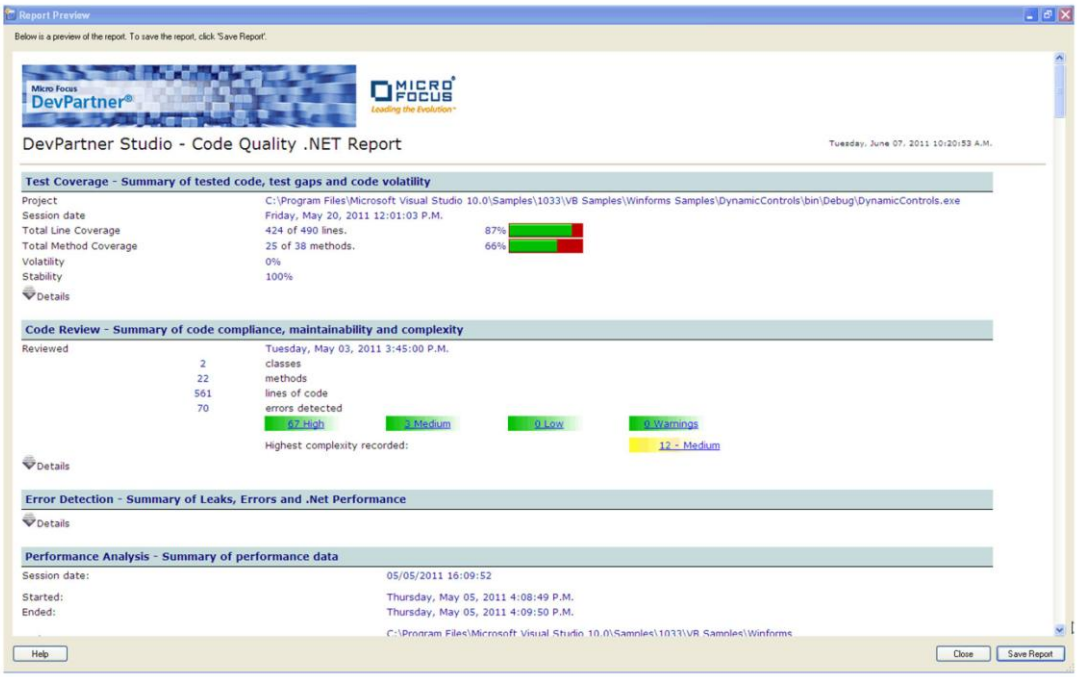
Once you have the Report Generator Open, choose the template for the report you want to create. DevPartner provides templates out of the box, or you can create and customize your own templates. Use the XSLT-based report templates as a starting point to create your own customized reports. Micro Focus recommends that you first create a copy of the default templates provided before you create your own templates.

Once you've selected the report template, you will be prompted with the Report Inputs. There are typically optional and required inputs. Add the appropriate inputs, including navigating to the required session files.

You can save the report parameters, by clicking the save button. This allows you to load the parameters for reuse.

Click on Generate Report once you've provided all the details.

DevPartner Report Preview



After you click Generate Report, a preview of the report is available. This lets you ensure that you've provided the correct report inputs and see what the report will look like. Click on Save Report to save the report in HTML format for viewing and use outside the preview window and outside of DevPartner Studio.

Module Exercise

Please turn to your Exercise Guide and complete

10_DevPartnerStudioReports-EG: Exercise 1

Command Line Execution

By the end of this module, you should be able to run DevPartner components from the command line.

Code Review Command Line

- Uses the configuration file (CR_solution-same.CRB) and batch file (CR_solution-name.bat)
- You can create your own batch file, or use one that can be automatically created during a Code Review session
- Creates a HTML-formatted summary file

You can run Code Review from the command line, which can be useful to run large solutions outside of the Visual Studio IDE or to run Code Review sessions overnight. The Command Line takes a configuration file that allows you to define the configuration for the Code Review, and you can use a batch file that you can create yourself, or that can be automatically created when you run a Code Review session. The result of running from the command line is an HTML-formatted summary file showing the issues found during the review.

To run a Solution Review from the Command Line

From the command line, change to the directory where the solution exists.

Enter the command: CRBatch /f <full path of configuration file name> If you previously ran a review on this solution in the interactive mode, DevPartner would have stored a configuration file in the solution's directory, i.e., CR_your_solution_name.CRB, as well as a batch file, i.e., CR_your_solution_name.BAT. These files allow you to run a command line review on this solution.

From the same path, execute the CR_your_solution_name.BAT batch file. This action loads Visual Studio with the solution referenced in the .CRB file. DevPartner reviews the code using the same criteria as the interactive review that originally produced these files.

Command Line

- DPAnalysis.exe is the command line executable for Coverage, Memory, Performance and Performance Expert sessions.
- Need to set switch to determine type of analysis.
- Does not instrument code – if you are running unmanaged code, you need to instrument your application first.
- Can save information in a configuration file to use instead of command line options.

There are two ways to use DPAnalysis.exe. You can run an analysis session directly from the command line using traditional command-line switches, or you can run an analysis session by launching DPAnalysis.exe and pointing to an XML configuration file.

You can use DPAnalysis.exe directly from the command line, using switches to direct the analysis session. For example, the following command line launches a performance analysis session for the application *target.exe* and saves the session file (.dpprf) to the c:\output directory:

dpanalysis.exe /perf /output c:\output\target.dppxp /p target.exe

Using DPAnalysis.exe from the command line, you can enable data collection and spawn a single process or service.

To manage analysis sessions with an XML configuration file, run DPAnalysis.exe from the command line with the /config switch and a properly structured XML configuration file as its target. For example:

dpanalysis.exe /config c:\temp\configuration_file.xml

By using a configuration file, you can profile and manage multiple processes or services. The ability to profile multiple processes can be especially useful for analyzing Web applications.

Sample Configuration File

```
<?xml version="1.0" ?>
 <ProductConfiguration xmlns="http://www.microfocus.com/products">
<RuntimeAnalysis Type="Performance" MaximumSessionDuration="1000" NoUIMsg="true" />
<Targets RunInParallel="true">
<Process CollectData="true" Spawn="true" NoWaitForCompletion="true">
<AnalysisOptions NO_QUANTUM="1" NM_METHOD_GRANULARITY="1"
SESSION_DIR="c:\temp" />
 <Path>ClientApp.exe</Path>
<Arguments>/arg1 /agr2 /arg3</Arguments>
<WorkingDirectory>c:\temp</WorkingDirectory>
<ExcludeImages> <Image>ClassLibrary1.dll</Image> <Image>ClassLibrary2.dll</Image>
</ExcludeImages> </Process>
<Service CollectData="true" Start="true" RestartIfRunning="true" RestartAtEndOfRun="true">
<AnalysisOptions NM_METHOD_GRANULARITY="0" EXCLUDE_SYSTEM_DLLS="1 • />
<Name>IISadmin</Name>
<Host>remotemachine</Host> </Service> </Targets> </ProductConfiguration>
```


Here is a sample configuration file. This shows an example of performance analysis against ClientApp.exe excluding two dlls. DevPartner provides sample configuration files that you can copy and edit for use in your environments.

The samples include:

Sample.Process.Config.xml

Sample.Service.Config.xml

Sample.WebApp.Config.xml

Sample.DCOM.Config.xml

Sample.ClassicASP_IIS_High_Isolation.Config.xml

Sample.ClassicASP_IIS_Low_Isolation.Config.xml

Sample.Multi_Process.Config.xml

The default installation places the files in this directory:

<install drive>:\Program Files\Micro Focus\DevPartner Studio\Analysis\SampleConfigs\

Error Detection

- **To check a program for errors**
  - BC *ProgramName*.exe
- **To run BC.exe in batch mode**
  - BC /B *OutputFileName*.dpbcl *ProgramName*.exe

You can run Error Detection from the command line using BC. This allows you to gather Error Detection information about your application outside of the Visual Studio IDE. This does not instrument your application, so if you run an uninstrumented application using the command line, it will perform ActiveCheck analysis against your application. To run with FinalCheck, instrument your application before running from the command line.