

MICROSOFT

Visual Studio Performance Testing Quick Reference Guide

A quick reference for users of the Team Testing
performance features of Visual Studio

Visual Studio Performance Testing Quick Reference Guide

4/1/2010

VSTS Rangers

This content was created by Geoff Gray with help from the Visual Studio Rangers team. “Our mission is to accelerate the adoption of Visual Studio by delivering out of band solutions for missing features or guidance. We work closely with members of Microsoft Services to make sure that our solutions address real world blockers.” -- Bijan Javidi, VSTS Rangers Lead

Summary

This document is a collection of items from public blog sites, Microsoft® internal discussion aliases (sanitized) and experiences from various Test Consultants in the Microsoft Services Labs. The idea is to provide quick reference points around various aspects of Microsoft Visual Studio® performance testing features that may not be covered in core documentation, or may not be easily understood. The different types of information cover:

- How does this feature work under the covers?
- How can I implement a workaround for this missing feature?
- This is a known bug and here is a fix or workaround.
- How do I troubleshoot issues I am having?

The document contains two Tables of Contents (high level overview, and list of every topic covered) as well as an index. The current plan is to update the document on a regular basis as new information is found.

The information contained in this document represents the current view of Microsoft Corporation on the issues discussed as of the date of publication. Because Microsoft must respond to changing market conditions, it should not be interpreted to be a commitment on the part of Microsoft, and Microsoft cannot guarantee the accuracy of any information presented after the date of publication.

This document is for informational purposes only. MICROSOFT MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE INFORMATION IN THIS DOCUMENT.

Microsoft grants you a license to this document under the terms of the Creative Commons Attribution 3.0 License. All other rights are reserved.

© 2010 Microsoft Corporation.

Microsoft, Active Directory, Excel, Internet Explorer, SQL Server, Visual Studio, and Windows are trademarks of the Microsoft group of companies.

All other trademarks are property of their respective owners.

Revision History

- Version 2.0
 - Released 2/16/09
 - Available externally on CodePlex
 - Major reformat of document
 - Added comprehensive index
- Version 3.0
 - Release Candidate published 3/23/2010
 - Added many VS 2010 performance testing articles
 - Added and updated articles about VS 2010 how-to's, issues, etc.
 - Added or updated articles for features "changed in 2010"
 - Updated many articles on issues with VS 2008
 - Added some deep dive articles about how VS performance testing works (both 2008 and 2010)
- Version 3.0a
 - Final release version for 3.0. This is the official release that should be used.
 - Published on 4/1/2010

NOTE

All items that are not marked with a version note should be considered to apply to both VS 2008 and VS 2010

List of Topics

NOTE FROM THE AUTHOR	8
HOW IT WORKS	9
How Web Tests Handle HTTP Headers	9
General Info (including order of execution) of load and web test plugins and rules	9
Client Code does not execute because Web Tests Work at the HTTP Layer	12
File Downloads, Download Size and Storage of files during Web Tests	12
When is the “Run unit tests in application domain” needed?	12
How the “Test Iterations” Setting impacts the total number of tests executed	12
Test timeout setting for load test configuration does not affect web tests	13
How user pacing and “Think Time Between Test Iterations” work	13
Load test warmup and cool down behaviors	13
What is the difference between Unique, Sequential and Random Data Sources	14
Comparing new users to return users	14
Goal based user behavior after the test finishes the warmup period	17
Threading models in Unit tests under load	18
Simulation of Browser Caching during load tests	19
The difference between Load Test Errors and Error Details	20
How parameterization of HIDDEN Fields works in a webtest	21
Testing execution order in Unit Tests	23
How machines in the test rig communicate	25
Changing the Default Port for Agent-Controller Communication	26
How to Add Agents To A Test Rig	26
ITEMS NEW TO VS 2010	27
“Find” feature now available in Webtest playback UI	27
“Go To Web Test” feature now available in Webtest playback UI	28
Recorder Log Available	29
Add extraction rule directly from the playback UI	30
New “Reporting Name” property for web requests	31
LoadTestResultsTables now differentiate between GET and POST requests	32
Virtual user visualization now available	33
New Excel reporting features built into load test results	39
New Load Test and Load Test Rig Licensing and configurations	40
New test mix: “Sequential Test Mix”	44
Query String and FORM POST URLs get parameterized	46
New options on Load Test Scenarios	47
Loops and Conditionals	48
CONFIGURATIONS AND SETTINGS	50
How to Change the Location Where Agents Store Run Files	50
How to set a proxy server for web tests	50
How to configure Web Tests so Fiddler can capture playback info	50

Controlling the amount of memory that the SQL Server Results machine consumes	51
How to configure the timeouts for deployment of load tests to agents	51
How to set the number of Load Test Errors and Error Details saved	52
Multi-proc boxes used as agents should have .NET garbage collection set to server mode	53
Location of list of all agents available to a controller	53
NETWORKS, IP SWITCHING, TEST STARTUPS	54
IP Address Switching anatomy (how it works)	54
Gotcha: IP Address Switching is ONLY for WEB TESTS	54
Gotcha: IP Addresses used for switching are not permanent	54
How to Setup IP Switching	55
Troubleshooting invalid view state and failed event validation	58
Startup: Slowness Restarting a Test Rig with Agents Marked as “Offline”	58
Startup: Multiple Network Cards can cause tests in a rig to not start	59
Startup: Slow startup can be caused by _NT_SYMBOL_PATH environment variable	59
Startup: tests on a Rig with Agents on a Slow Link	60
“Not Bound” Exception when using IP Switching is not really an error	60
How to configure the timeout for deployment of load tests to agents	61
PERFORMANCE COUNTERS AND DATA	62
Customizing the Available Microsoft System Monitor counter sets	62
Performance Counter Considerations on Rigs with slow links	64
Increase the performance counter sampling interval for longer tests	65
Changing the default counters shown in the graphs during testing	65
Possible method for fixing “missing perfmon counters” issues	65
How and where Performance data gets collected	66
DATA AND RESULTS	67
Custom Data Binding in UNIT Tests	67
Verifying saved results when a test hangs in the “In Progress” state after the test has finished	67
The metrics during and after a test differ from the results seen.	68
How new users and return users affect caching numbers	69
data sources for data driven tests get read only once	70
Consider including Timing Details to collect percentile data	71
Consider enabling SQL Tracing through the Load Test instead of separately	72
How to collect SQL counters from a non-default SQL instance	72
How 90% and 95% response times are calculated	72
Transaction Avg. Response Time vs. Request Avg. Response Time	73
Considerations for the location of the Load Test Results Store	73
Set the recovery model for the database to simple	73
How to clean up results data from runs that did not complete	74
InstanceName field in results database are appended with (002), (003), etc.	74
Layout for VSTS Load Test Results Store	74
How to view Test Results from the GUI	75
SQL Server Reporting Services Reports available for download	75
How to move results data to another system	75
Load Test Results without SQL NOT stored	76

Unable to EXPORT from Load Test Repository	76
Web Test TRX file and the NAN (Not a Number) Page Time entry	77
Proper understanding of TRX files and Test Results directory	78
Understanding the Response Size reported in web test runs	79
ERRORS AND KNOWN ISSUES	80
CSV files created in VSTS or saved as Unicode will not work as data sources	80
Incorrect SQL field type can cause errors in web tests	80
Leading zeroes dropped from datasource values bound to a CSV file	80
Recorded Think Times and paused web test recordings	80
After opening a webtest with the VS XML Editor, it will not open in declarative mode.	81
Calls to HTTPS://Urs.Microsoft.Com show up in your script	81
Possible DESKTOP HEAP errors when driving command line unit tests	81
Goal based load tests in VSTS 2008 do not work after applying SP1	82
Using Named Transactions in a Goal-Based Load Profile can cause errors	82
Debugging Errors in Load Tests	83
Debugging OutOfMemory Exceptions in Load Tests	83
Memory leak on load test when using HTTPS	83
"Not Trusted" error when starting a load test	84
Detail Logging may cause "Out of disk space" error	85
Error details and stack traces no longer available in VSTS 2010	85
VSTS does not appear to be using more than one processor	85
Changes made to Web Test Plugins may not show up properly	85
Socket errors or "Service Unavailable" errors when running a load test	86
Error "Failed to load results from the load test results store"	87
Hidden Field extraction rules do not handle some fields	87
Test results iteration count may be higher than the max test iterations set	87
In flight test iterations may not get reported	88
Completion of Unit Test causes spawned CMD processes to terminate	88
Bug with LoadProfile.Copy() method when used in custom goal based load tests	89
Errors in dependent requests in a Load Test do not show up in the details test log	90
WCF service load test gets time-outs after 10 requests	92
Loadtestitemresults.dat size runs into GBs	92
TROUBLESHOOTING	93
How to enable logging for test recording	93
Diagnosing and fixing Web Test recorder bar issues	93
User Account requirements and how to troubleshoot authentication	94
How to enable Verbose Logging on an agent for troubleshooting	95
Error that Browser Extensions are disabled when recording a web test	95
Troubleshooting invalid view state and failed event validation	96
Troubleshooting the VSTS Load Testing IP Switching Feature	97
Troubleshooting Guide for Visual Studio Test Controller and Agent	99
HOW TO, GOTCHAS AND BEST PRACTICES	111
How to call one coded web test from another	111
How to use methods other than GET and POST in a web test	111

How to filter out certain dependent requests	111
How to handle ASP.NET Cookie-less Sessions	112
How to use Client-side certificates in web tests	112
How to remove the “If-Modified-Since” header from dependent requests	113
How to handle custom data binding in web tests	113
How to add a datasource value to a context parameter	113
How to test Web Services with Unit Tests	114
How to add random users to web tests	114
How to add think time to a Unit Test	114
How to add details of a validation rule to your web test	115
How to mask a 404 error on a dependent request	116
How to parameterize Web Service calls within Web Tests	117
How to pass Load Test Context Parameters to Unit Tests	117
How to create Global Variables in a Unit Test	117
How to use Unit Tests to Drive Load with Command Line Apps	118
How to add Console Output to the results store when running Unit tests under load	118
How to add parameters to Load Tests	119
How to Change the Standard Deviation for a NormalDistribution ThinkTime	119
How to programmatically access the number of users in Load Tests	120
How to create a webtest plugin that will only execute on a predefined interval	120
How to support Context Parameters in a plug-in property	121
How to stop a web test in the middle of execution	122
How To: Modify the ServicePointManager to force SSLv3 instead of TLS (Default)	122
How To: Stop a Test in the PreRequest event	123
How to make a validation rule force a redirection to a new page	123
How to add a Web Service reference in a test project	127
How to remotely count connections to a process	129
How to hook into LoadTest database upon completion of a load test	129
How to deploy DLLs with MSTEST.EXE	130
How to authenticate with proxy before the test iteration begins	131
How to enumerate WebTextContext and Unit TestContext objects	132
How to manually move the data cursor	132
How to programmatically create a declarative web test	133
How to modify the string body programmatically in a declarative web test	134
Gotcha: Check Your Validation Level in the Load Test Run Settings	134
Gotcha: Do not adjust goals too quickly in your code	134
Gotcha: Response body capture limit is set to 1.5 MB by default	134
Gotcha: Caching of dependent requests is disabled when playing back Web Tests	135
Best Practice: Blog on various considerations for web tests running under load	135
Best Practice: Coded web tests and web test plug-ins should not block threads	135
Best Practice: considerations when creating a dynamic goal based load test plugin:	136
Best Practice: Add an Analysis Comment	136
Best Practice – Using comments in declarative webtests	136
EXTENSIBILITY	138
New Inner-text and Select-tag rules published on Codeplex	138

How to Add Custom Tabs to the Playback UI	139
ITEMS NOT SPECIFIC TO THE VSTS TESTING PLATFORM	146
Using the VSTS Application Profiler	146
VSTS 2008 Application Profiler New Features	146
Using System.NET Tracing to debug Network issues	146
Logparser tips and tricks	147
Logparser WEB Queries	147
LogParser Non-Web Queries	148
OLDER ARTICLES	149
Content-Length header not available in Web Request Object	149
SharePoint file upload test may post the file twice	149
Some Hidden Fields are not parameterized within AJAX calls	149
(FIX) Unit Test threading models and changing them	149
Bug in VSTS 2008 SP1 causes think time for redirected requests to be ignored in a load test	150
New Load Test Plugin Enhancements in VSTS 2008 SP1	150
Four New Methods added to the WebTestPlugin Class for 2008 SP1	150
INDEX	151

Note from the author

This new version of the Quick Reference Guide has been rearranged to attempt to make things easier to find. Many of the sub-topics have been removed and all of the main topics have been changed to reflect actions or needs instead of the components of the tool.

There is a full section near the beginning just on new features in Visual Studio 2010. This list is not even close to complete WRT all of the new Performance Testing features, let alone the tons of other testing features in general. You will also find information about changes to 2010 and issues with 2010 throughout the rest of the document. All of these should have a balloon stating that it is new or different.

Also please note that the Microsoft Visual Studio team has renamed the suite. Now the full suite (which contains the load testing features) is called “Visual Studio Ultimate”. Therefore you will see me referring to much of the 2010 stuff with “VS 2010” as opposed to the older style “VSTS 2008”.

Thanks to all of the people who have contributed articles and information. I look forward to hearing feedback as well as suggestions moving forward.

Sincerely,
Geoff Gray, Senior Test Consultant – Microsoft Testing Services Labs

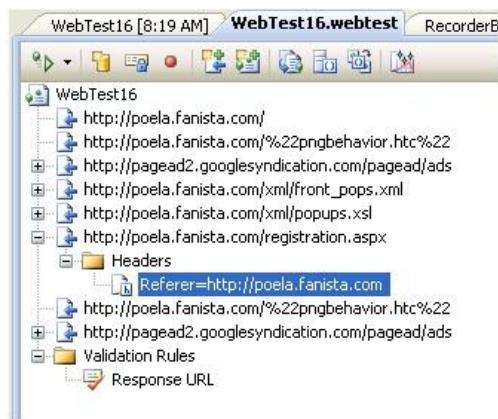
How It Works

How Web Tests Handle HTTP Headers

There are three different types of HTTP headers handled by Web tests:

- 1) Recorded Headers and headers explicitly added to the request. By default, the Web test recorder only records these headers:
 - "SOAPAction"
 - "Pragma"
 - "x-microsoftajax"
 - "Content-Type"
- 2) You can change the list of headers that the Visual Studio 2008 and 2010 web test recorder records in the registry by using regedit to open:
 - HKEY_CURRENT_USER\Software\Microsoft\VisualStudio\9.0\EnterpriseTools\QualityTools\Web LoadTest
 - Add a string value under this key with the name "RequestHeadersToRecord" and value="SOAPAction;Pragma;x-microsoftajax;Content-Type; Referrer"

If you do this and re-record your Web test, the Referrer header should be included in the request like this:



Referrer header in a declarative web test

- 3) Headers handled automatically by the engine. Two examples: 1) headers sent and received as part of authentication. These headers are handled in the Web test engine and can't be controlled by the test. 2) cookies, which can be controlled through the API.

General Info (including order of execution) of load and web test plugins and rules

WebTestPlugins get tied to a webtest at the main level of the test. The order of precedence is:

```
class WebTestPluginMethods : WebTestPlugin
{
    public override void PreWebTest(object sender, PreWebEventArgs e) { }
    public override void PreTransaction(object sender, PreTransactionEventArgs e) { }
    public override void PrePage(object sender, PrePageEventArgs e) { }
```

```

    public override void PreRequestDataBinding(object sender,
PreRequestEventArgs e) {}
    public override void PreRequest(object sender, PreRequestEventArgs e) {}

    public override void PostRequest(object sender, PostRequestEventArgs e) {}
    public override void PostPage(object sender, PostPageEventArgs e) {}
    public override void PostTransaction(object sender, PostTransactionEventArgs e) {}
    public override void PostWebTest(object sender, PostWebTestEventArgs e) {}
}

```

- **PreWebTest** fires before the first request is sent.
- **PreTransaction** is fired before all user defined transaction in the test.
- **PrePage** fires before any explicit request in the webtest. It also fires before any PreRequest method.
- **PrerequestDataBinding** fires before data from the context has been bound into the request. Gives an opportunity to change the data binding.
- **PreRequest** fires before ALL requests made, including redirects and dependant requests. If you want it to act on only redirects, or skip redirects. use the e.Request.IsRedirectFollow property to handle code flow.
- All Post<method> follow the exact opposite order as the Pre<method>

WebTestRequestPlugins get set at an individual request level and only operate on the request(s) they are explicitly tied to, and all redirects/dependant requests of that request.

```

class WebTestRequestPluginMethods : WebTestRequestPlugin
{
    public override void PreRequestDataBinding(object sender,
PreRequestEventArgs e) {}
    public override void PreRequest(object sender, PreRequestEventArgs e) {}
    public override void PostRequest(object sender, PostRequestEventArgs e) {}
}

```

ValidationRules can be assigned at the request level and at the webtest level. If the rule is assigned at the webtest level, it will fire after every request in the webtest. Otherwise it will fire after the request it is assigned to.

```

public class ValidationRule1 : ValidationRule
{
    public override void Validate(object sender, ValidationEventArgs e) {}
}

```

ExtractionRules can be assigned at the request level. It will fire after the request it is assigned to.

```

public class ExtractionRule1 : ExtractionRule
{
    public override void Extract(object sender, ExtractionEventArgs e) {}
}

```

NOTE: If you have multiple items attached to a request, then the order of precedence is:

- 1) PostRequest (request plugins fire before WebTestRequest plugins)
- 2) Extract
- 3) Validate

LoadTestPlugins get tied to the load tests directly. With VS 2005 and VS 2008, there can be only 1 plugin per loadtest, while VS 2010 adds >1 per test as well as LoadTestPlugin properties such that they are consistent with WebTestPlugins. The methods available are divided into three categories as shown below:

```
class LoadTestPlugins : ILoadTestPlugin
{
    void LoadTest_LoadTestStarting(object sender, EventArgs e) { }
    void LoadTest_LoadTestFinished(object sender, EventArgs e) { }
    void LoadTest_LoadTestAborted(object sender, LoadTestAbortedEventArgs e) { }
    void LoadTest_LoadTestWarmupComplete(object sender, EventArgs e) { }

    void LoadTest_TestFinished(object sender, TestFinishedEventArgs e) { }
    void LoadTest_TestSelected(object sender, TestSelectedEventArgs e) { }
    void LoadTest_TestStarting(object sender, TestStartingEventArgs e) { }

    void LoadTest_ThresholdExceeded(object sender, ThresholdExceededEventArgs e) { }
    void LoadTest_Heartbeat(object sender, HeartbeatEventArgs e) { }
}
```

- 1) These fire based on the load test (meaning each one will fire only once during a full test run)
- 2) These fire once per test iteration, per vUser.
- 3) Heartbeat fires once every second, on every agent.
- 4) ThresholdExceeded fires each time a given counter threshold is exceeded.

NOTE: Each method in section 1 will fire once PER physical agent machine, however since the agent machines are independent of each other, you do not need to worry about locking items to avoid contention.

NOTE: If you create or populate a context parameter inside the `LoadTest_TestStarting` method, it will not carry across to the next iteration.

Changed in 2010

- In VSTS 2010, you can have more than one LoadTest plugin, although there is no guarantee about the order in which they will execute.
- You can now control whether a validation rule fires BEFORE or AFTER dependent requests.
- at the end of recording a Web test, we now automatically add a Response Time Goal Validation rule at the Web test level, but this doesn't help much unless you click on the Toolbar button that lets you edit the response time goal as well as Think Time and Reporting Name for the Page for all recorded requests in a single grid

Client Code does not execute because Web Tests Work at the HTTP Layer

The following blog outlines where and how web tests work. This is important to understand if you are wondering why client side code is not tested.

<http://blogs.msdn.com/slumley/pages/web-tests-work-at-the-http-layer.aspx>

File Downloads, Download Size and Storage of files during Web Tests

The web test engine does not write responses to disk, so you don't need to specify a location for the file. It does read the entire response back to the client, but only stores the first 1.5M of the response in memory

You can override that using the `WebTestRequest.ResponseBodyCaptureLimit` property in the request's section of a coded web test.

When is the “Run unit tests in application domain” needed?

When a unit test is run by itself, a separate application domain is created in the test process for each unit test assembly. There is some overhead associated with marshalling tests and test results across the application domain boundary. An app domain is created by default when running unit tests in a load test. You can turn off the app domain using the load test run by using the Load Test editor's Run Setting's “Run unit tests in application domain”. This provides some performance boost in terms of the number of tests per second that the test process can execute before running out of CPU. The app domain is required for unit tests that use an app.config file.

How the “Test Iterations” Setting impacts the total number of tests executed

In the properties for the Run Settings of a load test, there is a property called “Test Iterations” that tells VSTS how many tests iterations to run during a load test. This is a global setting, so if you choose to run 5 iterations and you have 10 vusers, you will get FIVE total passes, not fifty. NOTE: you must enable this setting by changing the property “Use Test Iterations” from FALSE (default) to TRUE.

Test timeout setting for load test configuration does not affect web tests

The “Test Timeout” setting in the Test Run Configuration file (in the “Test -> Edit Test Run Configuration” menu) does not have an effect in all cases.

- **Uses the setting**
 - Running a single unit test, web test, ordered test, or generic test by itself
 - Running any of the above types of tests in a test run started from Test View, the Test List editor, or mstest.
 - Tests running in a load test (except Web tests)
- **Does not use the setting**
 - Running a Web test in a load test
 - The load test itself

This particular test timeout is enforced by the agent test execution code, but load test and Web test execution are tightly coupled for performance reasons and when a load test executes a Web test, the agent test execution code that enforces the test timeout setting is bypassed.

How user pacing and “Think Time Between Test Iterations” work

The setting “Think Time Between Test Iterations” is available in the properties for a load test scenario. This value is applied when a user completes one test, then the think time delay is applied before the user starts the next iteration. The setting applies to each iteration of each test in the scenario mix.

If you create a load test that has a test mix model “Based on user pace”, then the pacing calculated by the test engine will override any settings you declare for “Think Time Between Test Iterations”.

Load test warmup and cool down behaviors

For information about how warmup and cooldown affect the results, see the next section.

Warmup:

When you set a warmup time for a load test, VSTS will start running test iterations with a single user, and will ramp up to the proper initial user count over the duration of the warmup. The number of users ramped up are as follows:

- Constant User Load – the total number of users listed
- Step Load Pattern – the **initial** user count. The test will ramp from this number to the maximum number of users during the actual test run.

Cool down:

Changed in 2010

In 2008

The Load test Terminate method does not fire unless you use a cool down period.

In 2010

The Load test Terminate method always fires.

What is the difference between Unique, Sequential and Random Data Sources

Single Machine running tests

Sequential – This is the default and tells the web test to start with the first row then fetch rows in order from the data source. When it reaches the end of the data source, loop back to the beginning and start again. Continue until the load test completes. In a load test, the current row is kept for each data source in each web test, not for each user. When any user starts an iteration with a given Web test, they are given the next row of data and then the cursor is advanced.

Random – This indicates to choose rows at random. Continue until the load test completes.

Unique – This indicates to start with the first row and fetch rows in order. Once every row is used, stop the web test. If this is the only web test in the load test, then the load test will stop.

Multiple machines running as a rig

Sequential – This works the same as if you are on one machine. Each agent receives a full copy of the data and each starts with row 1 in the data source. Then each agent will run through each row in the data source and continue looping until the load test completes.

Random – This also works the same as if you run the test on one machine. Each agent will receive a full copy of the data source and randomly select rows.

Unique – This one works a little differently. Each row in the data source will be used once. So if you have 3 agents, the data will be spread across the 3 agents and no row will be used more than once. As with one machine, once every row is used, the web test will stop executing.

Comparing new users to return users

There is a property in the Load Test Scenario settings for “Percentage of new users”. This setting has impact on a few different aspects of the load test execution. The percentage is a measure of how many of the simulated users are pretending to be “brand new” to the site, and how many are pretending to be “users who have been to the site before”.

A better term to describe a new user is “One Time User”. This is because a new user goes away at the end of its iteration. It does not “replace” a different user in the pool. Therefore, the term “New User” should be considered to be a “One Time” user.

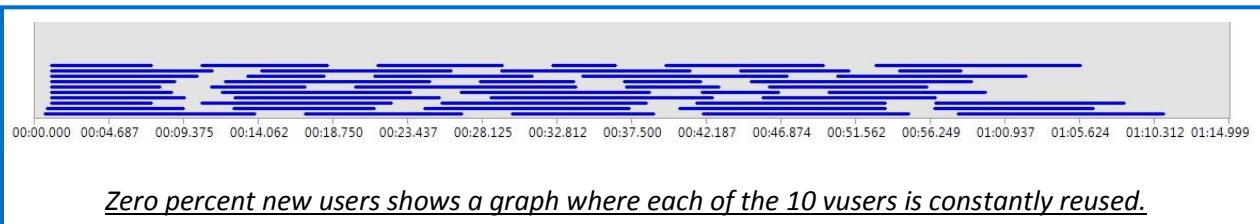
The “Percentage of New Users” affects the following whether the tests contained within the load test are **Web tests or unit tests**:

- The value of the LoadTestUserId in the LoadTestUserContext object. This only matters for unit tests and coded Web tests that use this property in their code. On the other hand if you set the number of test iterations equal to the user load, then you should get a different LoadTestUserId regardless of the setting of “Percentage of New Users”.
- If you are using the load test feature that allows you to define an “Initial Test” and/or a “Terminate Test” for a virtual user, then it affects when the InitializeTest and TerminateTest are run: for “new users” (a more accurate name might be “one time users”, the InitializeTest is run for the virtual user, the “Body Test” is run just once, and then the “Terminate Test” is run. For users who are NOT “new users”, the InitializeTest is run once, the Body Test is run many times (until the load test completes), and then the TerminateTest runs (which might be during the cool-down period).

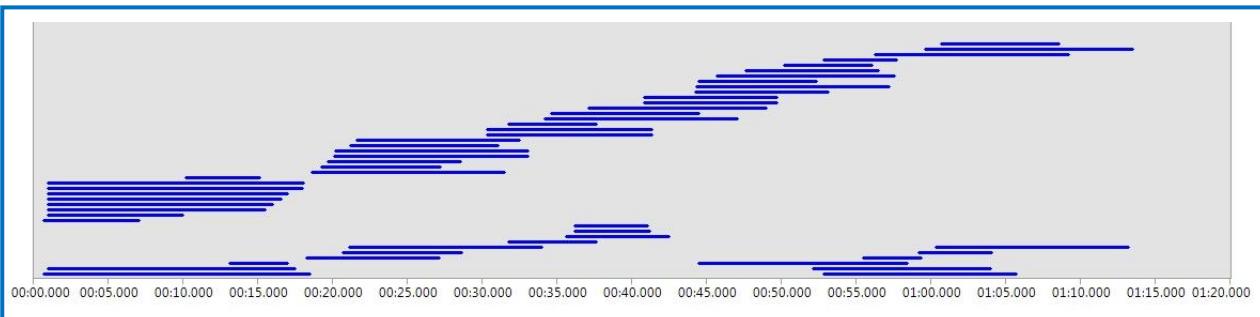
The “Percentage of New Users” affects the following **Web test** features that are not applicable for unit tests:

- The simulation of browser caching. The option affects how the VUser virtual browser cache is maintained between iterations of Tests. “New users” have an empty cache (not the responses are not actually cached, only the urls are tracked), “return users” have a cache. So if this value is 100% all Vusers starting a Test will be starting with an empty browser cache. If this value is 0% all VUsers will maintain the state of the browser cache between iterations of Web Tests. This setting affects the amount of content that is downloaded. If an object sits in a Vuser cache and if the object has not been modified since the last time the Vuser downloaded it, the object will not be downloaded. Therefore, new users will download more content versus returning users with items in their browser cache.
- The handling of cookie for a Web test virtual user: new users always start running a Web test with all cookies cleared. When a user who is not a “new user” runs an Web test after the first one run, the cookies set during previous Web tests for that virtual user are present.

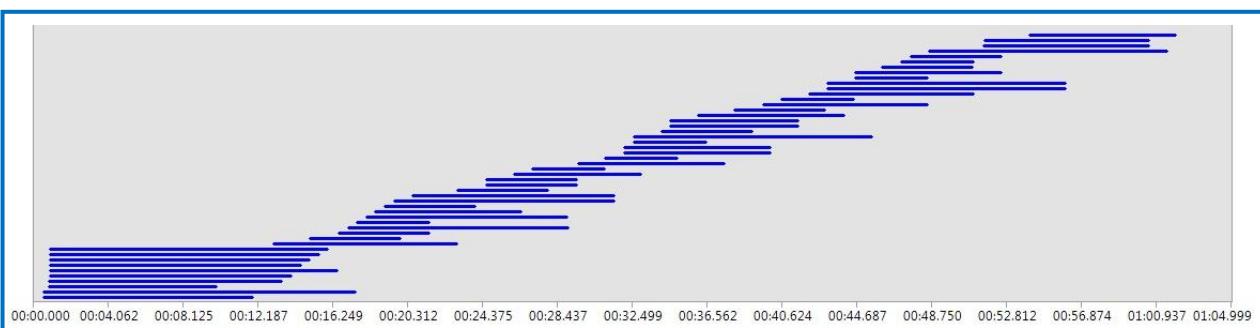
The below graphs (taken from test runs in VSTS 2010) demonstrate the difference between a new user and a return user. The graphs are based on a 10 user / 50 iteration run, but with different percentages for “new users” on each run. [NOTE: The graphs below are new to VSTS 2010, but the way in which users are simulated is the same as in VSTS 2008. For a better understanding of these graphs, go to the section called “Virtual user visualization now available”.](#)



Zero percent new users shows a graph where each of the 10 vusers is constantly reused.



Fifty percent new users shows a graph where each of the 10 vusers is constantly reused by half of the iterations, but the other half are split out among new vusers which never get reused.



One hundred percent new users shows a graph where none of the vusers is ever reused.

Goal based user behavior after the test finishes the warmup period

1. The user load starts at the value specified by the Initial User Count property of the Goal Based Load Pattern.
2. At each sampling interval (which defaults to 5 seconds, but can be modified by the “Sample Rate” property in the load test run settings), the performance counter defined in the goal based load pattern is sampled. (If it can’t be sampled for some reason, an error is logged and the user load remains the same.)
3. The value sampled is compared with the “Low End” and “High End” properties of the “Target Range for Performance Counter”.
4. If the value is within the boundaries of the “Low End” and “High End”, the user load remains the same.
5. If the value is **not** within the boundaries of the “Low End” and “High End”, the user load is adjusted as follows:
 - The midpoint of the target range for the goal is divided by the sample value for the goal performance counter to calculate an “adjustment factor”.
 - For example, if the goal is defined as “% Processor Time” between 50 and 70, the midpoint is 60. If the sampled value for % Processor Time is 40, then AdjustmentFactor = 60/40 = 1.5, or if the sampled value is 80, the AdjustmentFactor = 60/80 = 0.75.
 - The AdjustmentFactor is multiplied by the current user load to get the new user load.
 - However, if the difference between the new user load and the current user load is greater than the “Maximum User Count Increase/Decrease” property (whichever applies), then the user load is only adjusted by as much as max increase/decrease property. My experience has been that keeping these values fairly small is a good idea; otherwise the algorithm tends to cause too much fluctuation (the perf counter keeps going above and below the target range).
 - The new user load can also not be larger than the value specified by the goal based pattern’s MaximumUserCount property or less than the Minimum User Count property.
 - Two more considerations based on special properties of the goal based load pattern:
 - If the property “Lower Values Imply Higher Resource Use” is True (which you might use for example for a performance count such as Memory\Available Mbytes), then the user load is adjusted in the opposite direction: the user load is decreased when the sampled counter value is less than the Low End of the target range and increased when the user load is greater than the High End of the target range.
 - If the property “Stop Adjusting User Count When Goal Achieved” is True, then once the sampled goal performance counter is within the target range for 3 consecutive sampling intervals, then the user load is no longer adjusted and remains constant for the remainder of the load test.
 - Lastly, as is true for all of the user load patterns, in a test rig with multiple agents, the new user load is distributed among the agents equally by default, or according to the “Agent Weightings” if these are specified in the agent properties.

Threading models in Unit tests under load

When running unit tests in a load test, there is one thread for each virtual user that is currently running a unit test. The load test engine doesn't know what's going on inside the unit test and needs to run each on a separate thread to ensure that a thread will be available to start the next unit test without delay. However, if you specify the Test Mix Based on User Pace feature (or specify a non-zero value for "Think Time Between Test Iterations" (a property on each Scenario in the load test)), then the number of concurrent virtual users is less than the total number of virtual users, and there is only one thread needed in the thread pool for each concurrent virtual user.

There is an extra thread for each unit test execution thread that is used to monitor the execution of the unit test, implement timing out of the test, etc. However, the stack size for this thread is smaller than the default size so it should take up less memory.

More information can be found at: <http://blogs.msdn.com/billbar/pages/features-and-behavior-of-load-tests-containing-unit-tests-in-vsts-2008.aspx>

Simulation of Browser Caching during load tests

In a VSTS load test that contains Web tests, the load test attempts to simulate the caching behavior of the browser. Here are some notes on how that is done:

- There is a property named on each request in a Web test named “Cache Control” in the Web test editor (and named “Cache” on the WebTestRequest object in the API used by coded Web tests).
- When the Cache Control property on a request in the Web test is false, the request is always issued.
- When the Cache Control property is true, the VSTS load test runtime code attempts to emulate the Internet Explorer caching behavior (with the “Automatically” setting). This includes reading and following the HTTP cache control directives.
- The Cache Control property is automatically set to true for all dependent requests (typically for images, style sheets, etc embedded on the page).
- In a load test, the browser caching behavior is simulated separately for each user running in the load test.
- When a virtual user in a load test completes a Web test and a new Web test session is started to keep the user load at the same level, sometimes the load test starts simulates a “new user” with a clean cache, and sometimes the load test simulates a return user that has items cached from a previous session. This is determined by the “Percentage of New Users” property on the Scenario in the load test. The default for “Percentage of New Users” is 0.

Important Note: When running a Web test by itself (outside of the load test), the Cache Control property is automatically set to false for all dependent requests so they are always fetched; this is so that they can be displayed in the browser pane of the Web test results viewer without broken images.

The difference between Load Test Errors and Error Details

There's a distinction between "Errors" and "Error Details" within Load Test results.

1. "**Load Test Errors**" refers to any type of error that occurs in the load test. The info saved is the user/requestURI/error text information. By default the load test results will save only 1000 errors of a particular type. This value is configured through a config file.
2. "**Load Test Error Details**" refers to the additional detail we capture for errors on Web test requests: mostly the request and response body. The default value is 100. This value is configured in the Load Test GUI.

A screenshot of the Visual Studio Load Test Results viewer. The title bar shows '59 PM | LoadTest1.loadtest | geoffgr_GEOFFGR2...-12 18_03_35.trx | MortgagePaymentTest.cs | testAp'. Below the title bar are tabs for 'Graphs' and 'Tables'. The main area displays the 'Errors' table. The table has two columns: 'Type' and 'Subtype'. The rows show:

- Total (Count: 29)
- Timeout (Type: Timeout, Subtype: WebTestException)
- Exception (Type: Exception, Subtype: LoadTestAgentResultsLateException)

Each row has a link in the 'Last Message' column. The first link points to a detailed error message: 'Request timed out' and 'There is no context parameter with SEVERE ERROR: Results from some'.

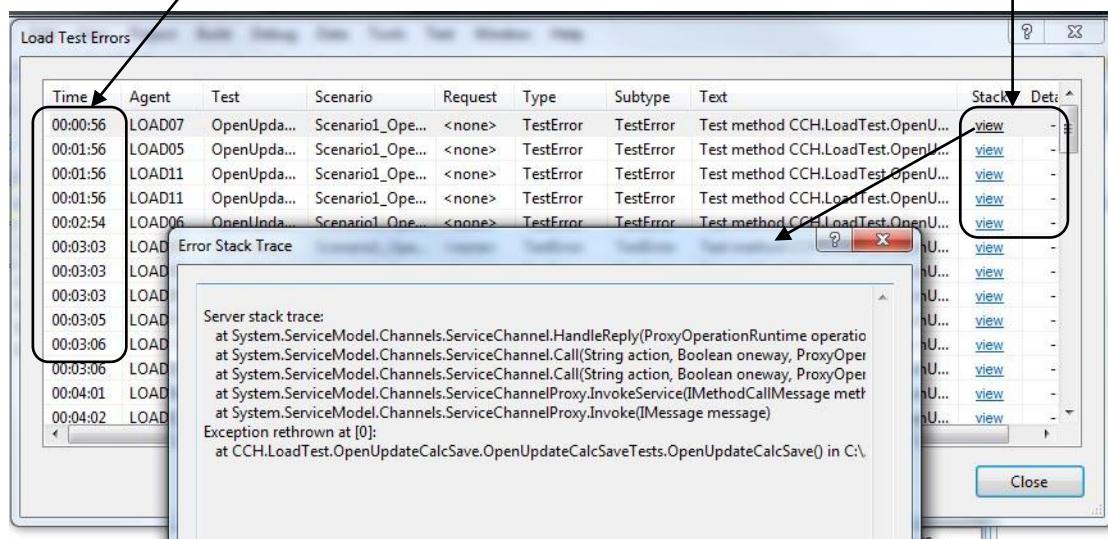
This is the display of the Errors table in the test results viewer.

Each of these is a separate type of error and gets its own quantity of "errors" (#1) and "error details" (#2)

The number of "errors" is shown in the Count column. Clicking on one of the numbers will bring up the Load Test Errors dialog below. There is no count displayed for "error details".

Each line here is one of the "errors" entries (#1).

Any "errors" entry (#1) that has an associated "error details" will have a link in one or both of the last columns. Click on these to get the details about that specific error instance.



How parameterization of HIDDEN Fields works in a webtest

For each extract hidden fields (using the built in “Extract Hidden”) rule in a webtest, any context items with the same name will be removed prior to extracting the new values. So if request 1 extracts 4 hidden values into a context “Hidden1”, then request 2 extracts only 2 hidden values, also into a context called “Hidden 1”, then the resultant collection for “Hidden1” will contain ONLY the two values extracted for request 2.

“Hidden Field Buckets”

In the example above, Hidden1 and Hidden2 represent hidden field buckets. We call the number at the end as the bucket number, e.g. \$HIDDEN0 is bucket 0.

The easiest example to explain is a frames page with two frames. Each frame will have an independent bucket, and requests can be interleaved across the frames. Other examples that require multiple buckets are popup windows and certain AJAX calls (since web tests support correlation of viewstate in ASP.NET AJAX responses).

Hidden field matching

The algorithm to determine that a given request matches a particular bucket uses the heuristic that the hidden fields parsed out of the response will match form post fields on a subsequent request.

E.g. if the recorder parses out of a response

- <INPUT type=hidden ID=Field1 value=v1>
- <INPUT type=hidden ID=Field2 value=v2>

Then on a subsequent post we see Field1 and Field2 posted, then this request and response match and a hidden field bucket will be created for them. The first available bucket number is assigned to the hidden field bucket.

Once a bucket is “consumed” by a subsequent request via binding, that bucket is made available again. So if the test has a single frame, it will always reuse bucket 0:

- Page 1
 - Extract bucket 0
- Page 2
 - Bind bucket 0 params
- Page 3
 - Extract bucket 0
- Page 4
 - Bind bucket 0 params

If a test has 2 frames that interleave requests, it will use two buckets:

- Frame 1, Page 1
 - Extract bucket 0
- Frame 2, Page 1
 - Extract bucket 1
- Frame 2, Page 2
 - Bind bucket 1 params
- Frame 1, Page 2
 - Bind bucket 0 params

Or if a test uses a popup window, or Viewstate, you would see a similar pattern as the frames page where multiple buckets are used to keep the window state.

Why are some fields unbound?

Some hidden fields values are modified in java script, such as EVENT_ARGUMENT. In that case, it won't work to simply extract the value from the hidden field in the response and play it back. If the recorder detects this is the case, it put the actual value that was posted back as the form post parameter value rather than binding it to the hidden field.

A single page will have just one hidden field extraction rule applied. If there are multiple forms on a given page, there is still just one down-stream post of form fields, resulting in one application of the hidden field extraction rule.

Testing execution order in Unit Tests

I think that most confusion comes from some user's expectation of MSTest to execute like the Nunit framework. They execute differently since Nunit instantiates a test class only once when executing all the tests contained in it, whereas MSTest instantiates each test method's class separately during the execution process, with each instantiation occurring on a separate thread. This design affects 3 specific things which often confuse users of MSTest:

1. **ClassInitialize and ClassCleanup:** Since ClassInitialize and ClassCleanUp are static, they are only executed once even though several instances of a test class can be created by MSTest. ClassInitialize executes in the instance of the test class corresponding to the first test method in the test class. Similarly, MSTest executes ClassCleanUp in the instance of the test class corresponding to the last test method in the test class.
2. **Execution Interleaving:** Since each instance of the test class is instantiated separately on a different thread, there are no guarantees regarding the order of execution of unit tests in a single class, or across classes. The execution of tests may be interleaved across classes, and potentially even assemblies, depending on how you chose to execute your tests. The key thing here is – all tests could be executed in any order, it is totally undefined.
3. **TestContext Instances:** [TestContexts](#) are different for each test method, with no sharing between test methods.

For example, if we have a Test Class:

```
[TestClass]
public class VSTSClass1
{
    private TestContext testContextInstance;

    public TestContext TestContext
    {
        get
        {
            return testContextInstance;
        }
        set
        {
            testContextInstance = value;
        }
    }

    [ClassInitialize]
    public static void ClassSetup(TestContext a)
    {
        Console.WriteLine("Class Setup");
    }
    [TestInitialize]
    public void TestInit()
    {
        Console.WriteLine("Test Init");
    }
}
```

```

[TestMethod]
public void Test1()
{
    Console.WriteLine("Test1");
}

[TestMethod]
public void Test2()
{
    Console.WriteLine("Test2");
}

[TestMethod]
public void Test3()
{
    Console.WriteLine("Test3");
}

[TestCleanup]
public void TestCleanUp()
{
    Console.WriteLine("TestCleanUp");
}

[ClassCleanup]
public static void ClassCleanUp ()
{
    Console.WriteLine("ClassCleanUp");
}
}

```

(This consists of 3 Test Methods, ClassInitialize, ClassCleanup, TestInitialize, TestCleanUp and an explicit declaration of TestContext)

The execution order would be as follows:

Test1 [Thread 1]: new TestContext -> ClassInitialize -> TestInitialize -> TestMethod1 ->
TestCleanUp
Test2 [Thread 2]: new TestContext -> TestInitialize -> TestMethod2 -> TestCleanUp
Test3 [Thread 3]: new TestContext -> TestInitialize -> TestMethod2 -> TestCleanUp ->
ClassCleanUp

The output after running all the tests in the class would be:

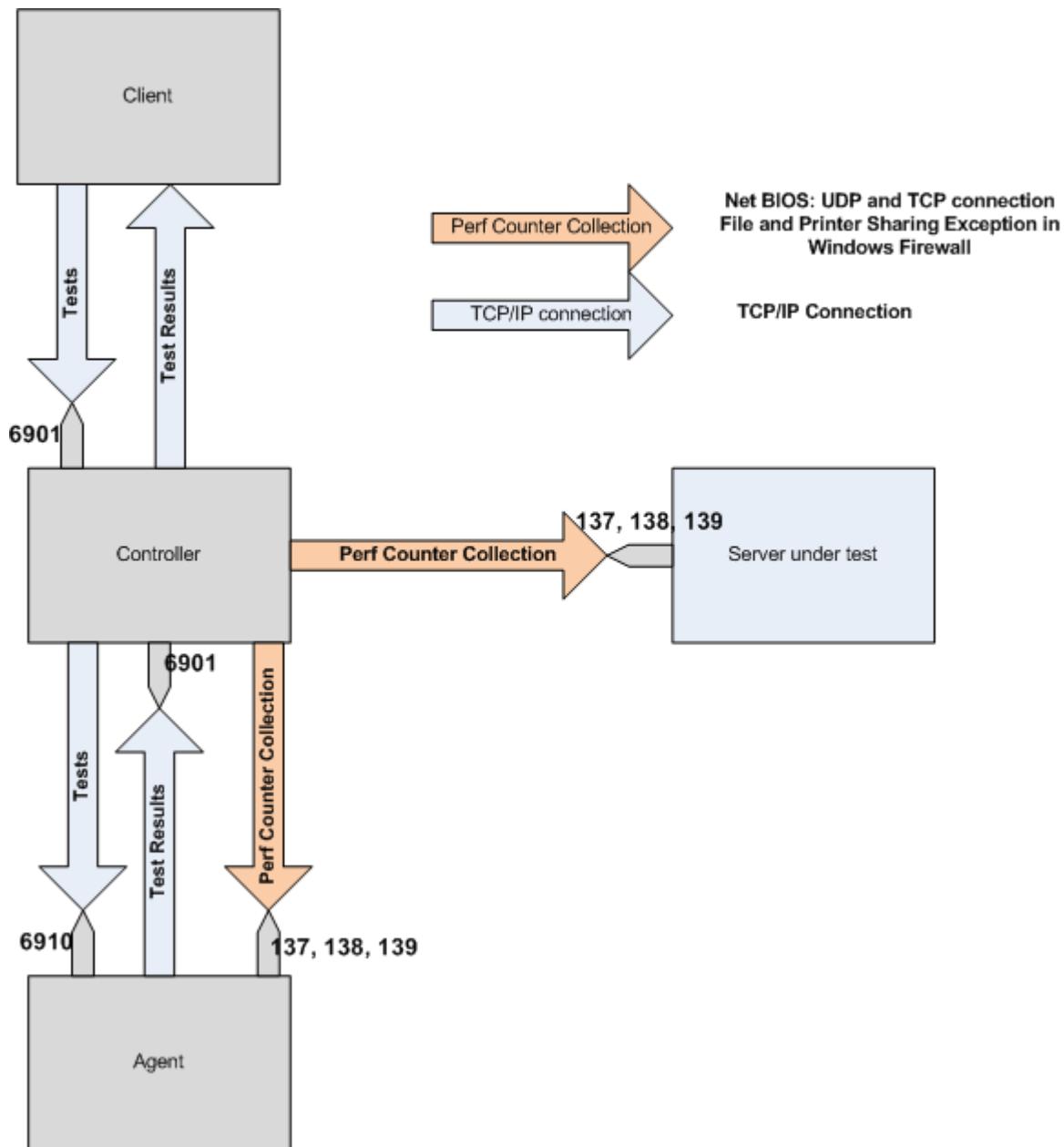
```

Class Setup
Test Init
Test1
TestCleanUp
Test Init
Test2
TestCleanUp
Test Init
Test3
TestCleanUp
ClassCleanUp

```

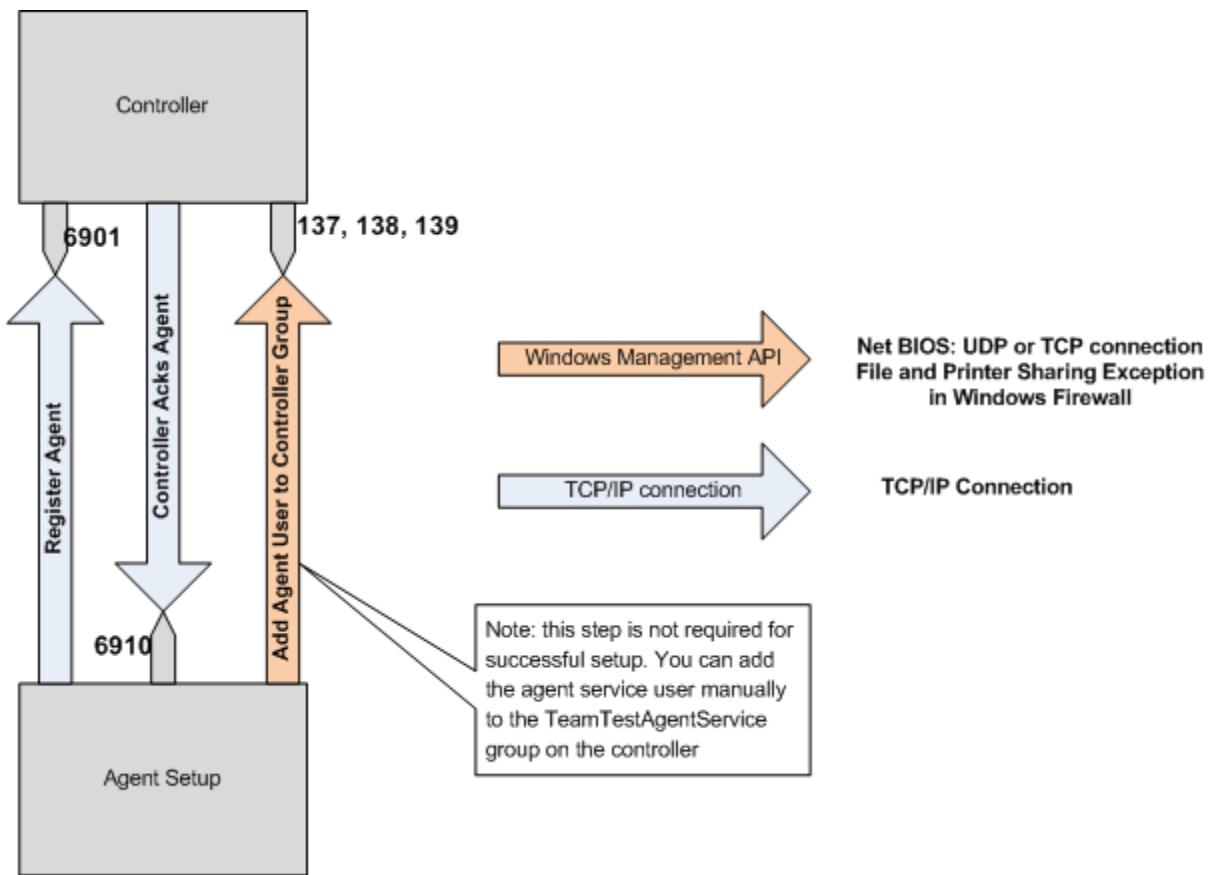
How machines in the test rig communicate

The below Visio diagrams that shows which ports are used during setup and when the agent and controller run tests.



Controller-Agent Communications

And here are the connections used during agent setup:



Controller-Agent Communications

Changing the Default Port for Agent-Controller Communication

The default port for communication is 6910. To change this, see the following post:

<http://blogs.msdn.com/billbar/archive/2007/07/31/configuring-a-non-default-port-number-for-the-vs-team-test-controller.aspx>

How to Add Agents To A Test Rig

When you uninstall the controller software and reinstall it, the local user group that contains the agent accounts used to connect is reset. You must repopulate the group with the appropriate users. From Start -> Run, type in "lusrmgr.msc" and then expand the Groups items and open the "TeamTestAgentService" group. Add the user account(s) used when setting up your agents.

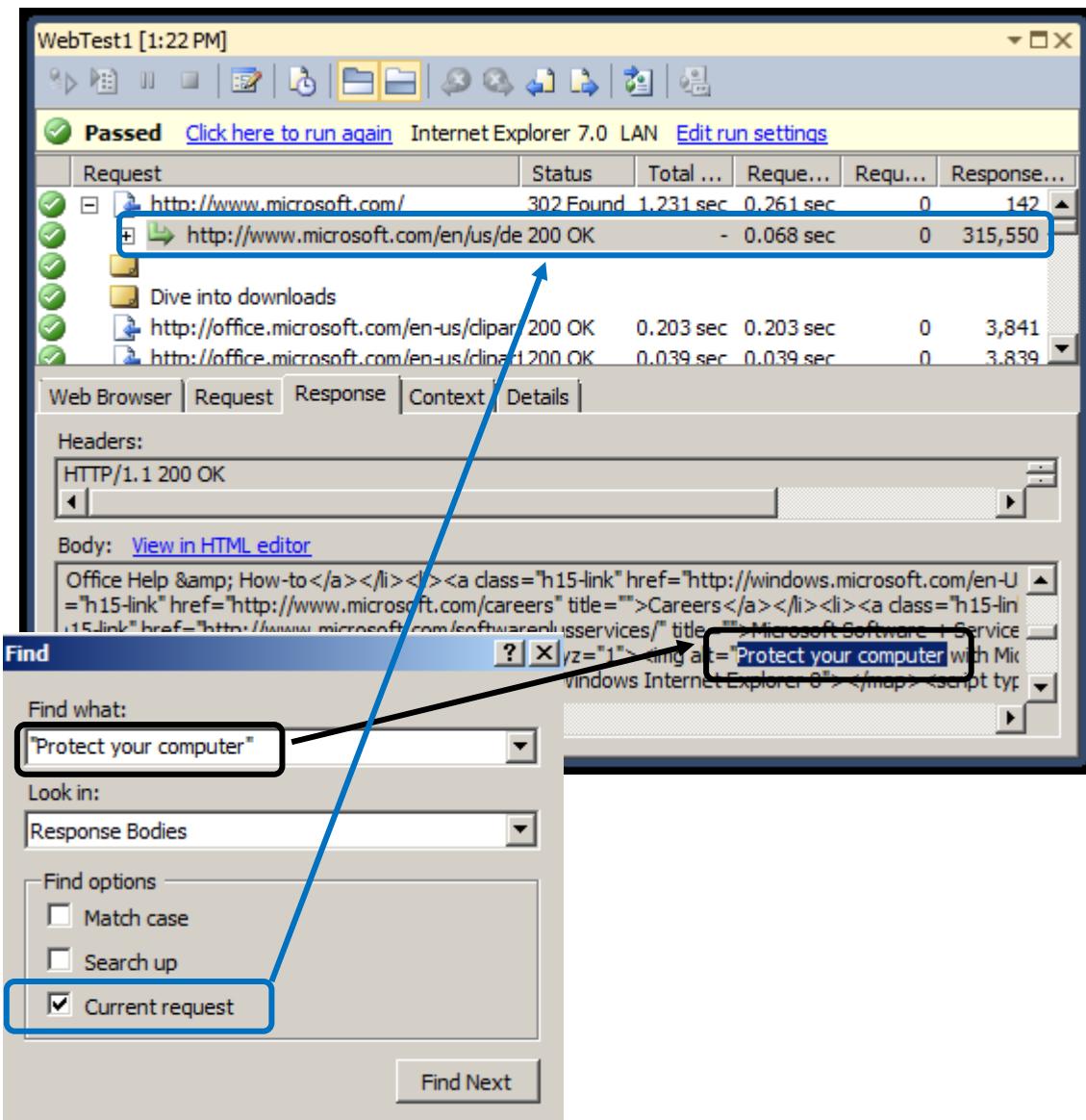
Next, open VSTS and open up the Test Rig Management dialog (Test -> Administer Test Controllers) and add each agent back to the list.

Or if you have VS 2010, you can go to each agent and re-run the config tool, which will automatically add the agent back to the controller.

Items new to VS 2010

"Find" feature now available in Webtest playback UI

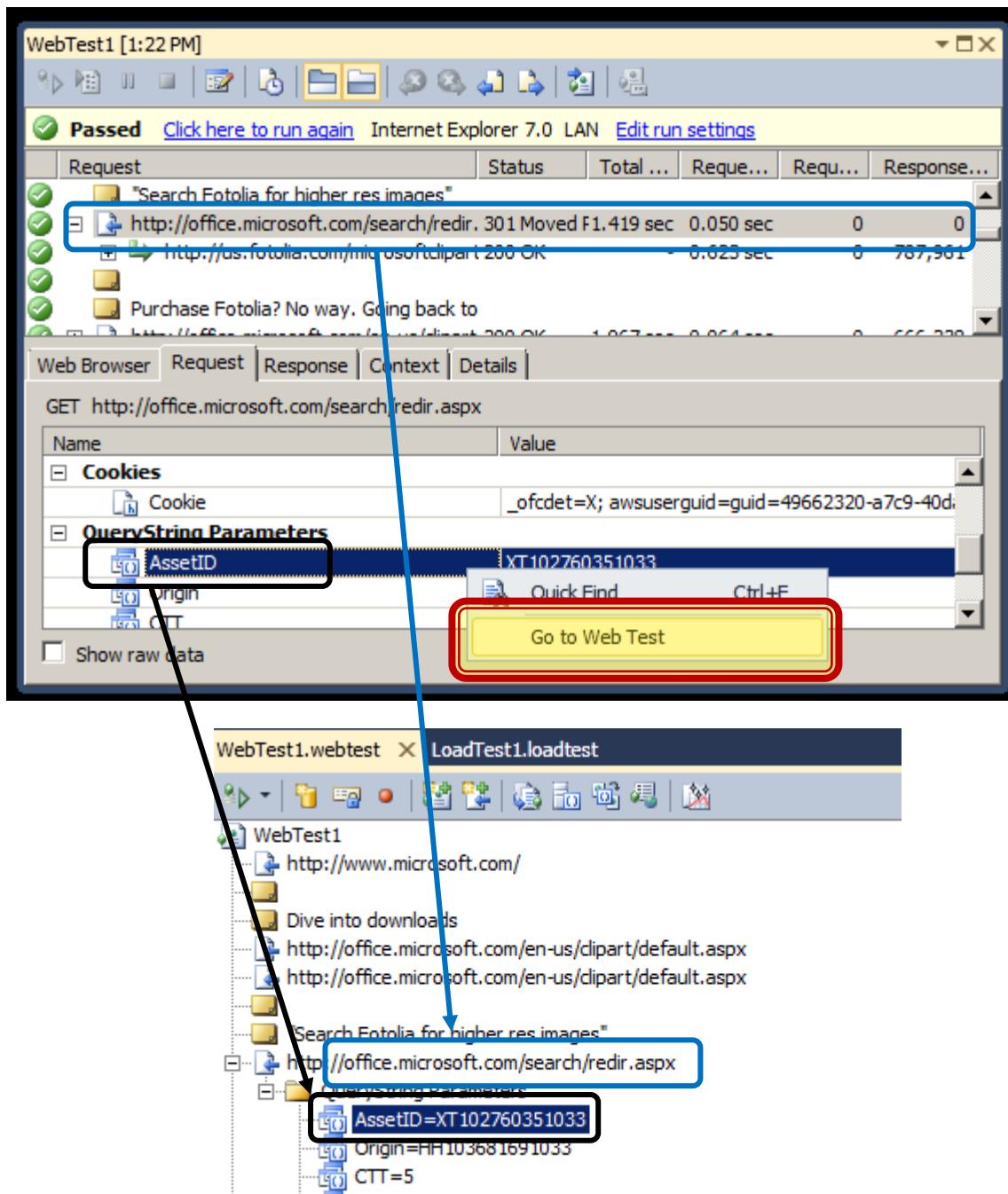
In VS 2010, you can now directly search for values in the playback window of the UI. With the playback window active, press Ctrl-F to open the "find" dialog box. You then type in the phrase to search for. You can also choose whether to look in the request, the response, the headers, all text, etc. You can further refine the search by limiting to the currently highlighted request.



You can also right-click on a form post or query string parameter in the request tab to start a search.

"Go To Web Test" feature now available in Webtest playback UI

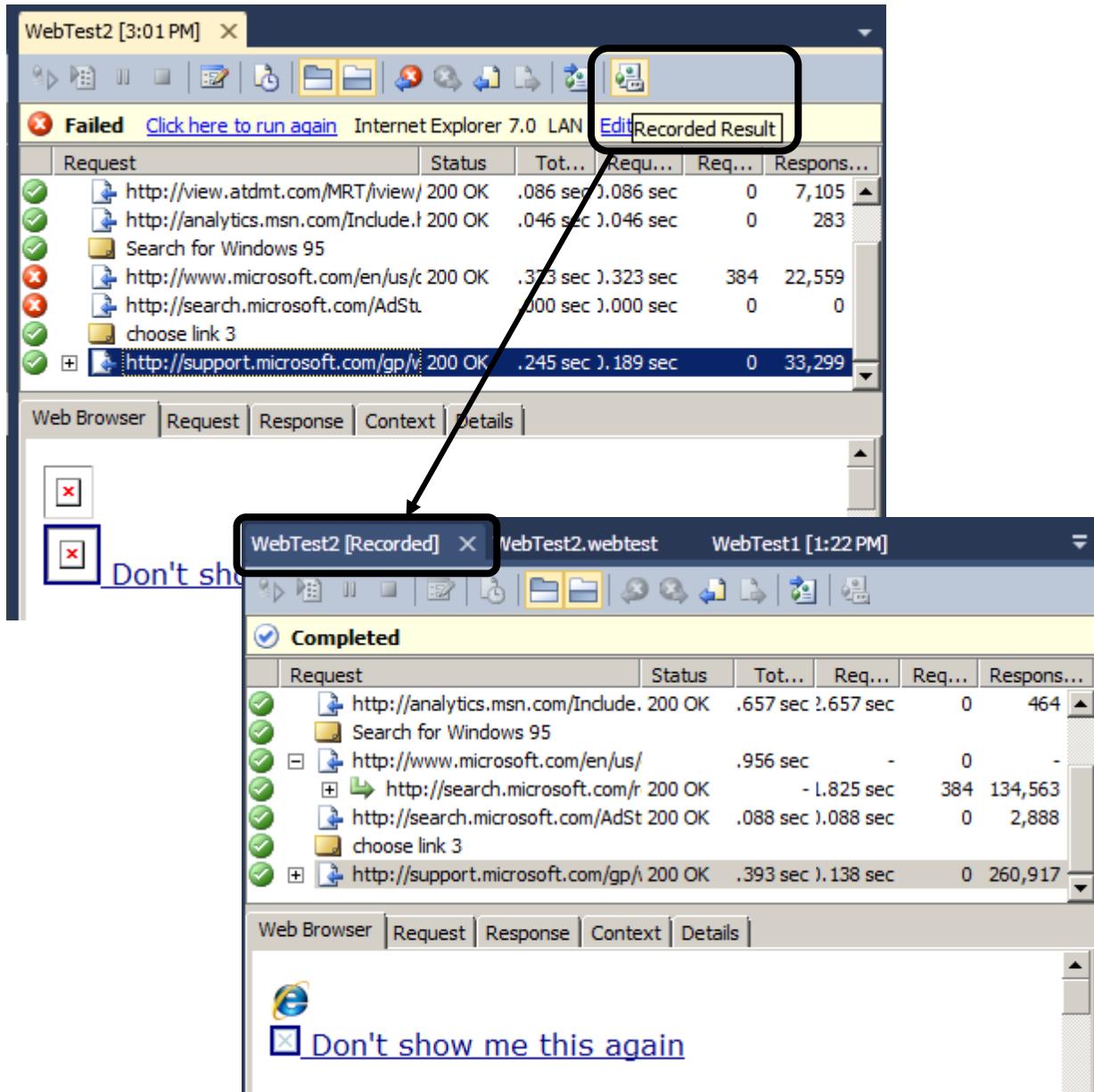
In VS 2010, you can now highlight a specific value shown in the playback window, right-click, and choose "Go to web test". This will open the web test window itself and highlight the item whose value you chose. The feature works on the specific request currently highlighted, so if you have several requests with the same parameter name, you will be directed to the request that directly corresponds to the request you were looking at in the playback window.



Recorder Log Available

In VS 2010, as you record a new Web test the recorded requests are saved to a Web test log file. Any time you are in a new playback screen for this Web test, you can click on the Recorded Result menu bar command to open the recorded requests and responses. (NOTE: if you upgrade a project from 2008 or if you manually delete the original playback file, the button will be grayed out).

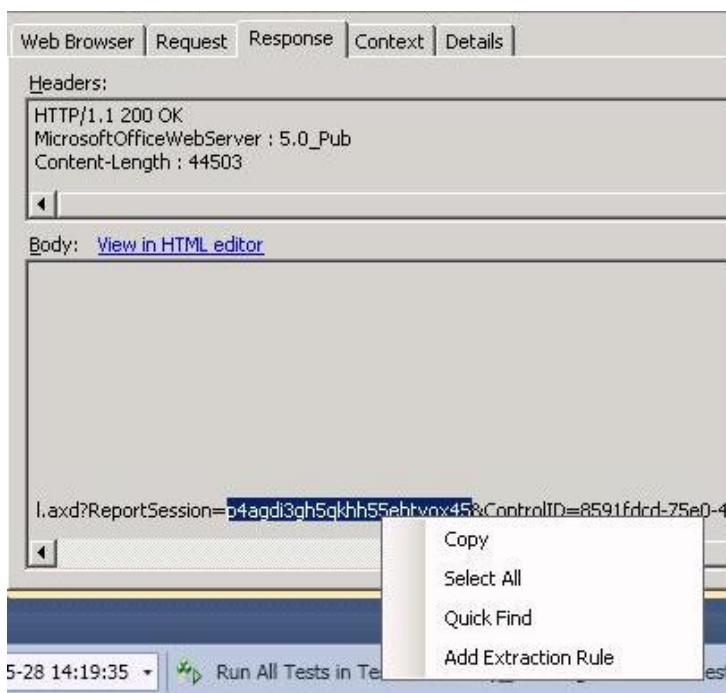
The recording will have the same name appended with “[Recorded].” This gives you the ability to see the requests the browser made and the responses during recording, and compare them to what the web test is sending and receiving. You can also search the recording for specific values that were recorded.



Add extraction rule directly from the playback UI

In the playback window, you can highlight any static value from a response that you wish to extract for use in future requests. Simply highlight the value, right click, and choose **Add Extraction Rule**. It will automatically name the rule, name the parameter and add the rule to the right request in the test. You will still have to go to the subsequent request(s) where you want to use the parameter and add the parameter to the request. If the value is found in the Web test, you will also be prompted to do a search and replace of the value with the context parameter binding.

Tip: if this value changes each time the test is run, the value from the result viewer will not be in the editor. So rather than adding the extraction rule from the test result, add it from the recorder log instead (since this will have the recorded value, which will also be in the Web test).



New “Reporting Name” property for web requests

Web requests now have a new property exposed called “Reporting Name.” This property allows you to define any string to use in test results instead of the actual request URL. This is very handy for requests with very long URLs or tests where there are several requests to the exact same URL. In the following Web test, most requests are to the same URL, but the results are changed to show the “Reporting Name” values set.

The screenshot illustrates the configuration and execution of a web test named "UpdatePanelTesting.webtest".

Top Left: The "UpdatePanelTesting.webtest" editor window shows a tree view of test steps. Several steps point to the URL `{WebServer1}/HOL/CallWebService.aspx`, which is highlighted with a blue box. A black curved arrow points from this step to the "Properties" window.

Top Right: The "Properties" window displays settings for the selected request. The "Reporting Name" setting is explicitly defined as `CallWebService - Async Timer 2`, also highlighted with a blue box. Other properties shown include Cache Control (False), Encoding (utf-8), and Expected HTTP Status (200).

Bottom: The "Lab Exercise step" window shows the execution results. It lists requests with their status and execution time. The first request, "Going to the good old home page", has a status of "200 OK" and a duration of "0.352 sec". The second request, "Now going to the UpdatePanel Page, first pass", is highlighted with a red box and has a status of "200 OK" and a duration of "2.712 sec". Subsequent requests, such as "Firing on Async Timer event" and "CallWebService - Async Timer 1", also have reporting names defined and are listed with their details. A blue arrow points from the "CallWebService - Async Timer 2" entry in the properties window to the corresponding entry in the execution results.

Bottom Right Callout: A callout box contains the text: "A request without any reporting name defined." It points to the third request in the list, "CallWebService - Async Timer 2", which does not have a red box around it, indicating it was run without a defined reporting name.

Request	Status	Total Ti...
Going to the good old home page	200 OK	0.352 sec
Now going to the UpdatePanel Page, first pass	200 OK	2.712 sec
Firing on Async Timer event	200 OK	0.060 sec
CallWebService - Async Timer 1	200 OK	0.031 sec
CallWebService - Async Timer 2	200 OK	0.001 sec
CallWebService - random string #1	200 OK	0.003 sec
Firing on Async Timer event	200 OK	0.001 sec
CallWebService - random string #2	200 OK	0.001 sec

Bottom Navigation: The "Web Browser" tab is selected, showing the URL `POST http://localhost:81/HOL/CallWebService.aspx`. Below it, the "Headers" section is expanded, showing a table with columns "Name" and "Value".

LoadTestResultsTables now differentiate between GET and POST requests

If the webtest in the previous section (“Reporting Name Property”) is executed in a load test, there are two features you can see in the results.

- 1) Any Reporting Names you used will show up in the results table.
- 2) Any requests with the same name but with different methods will be reported separately.

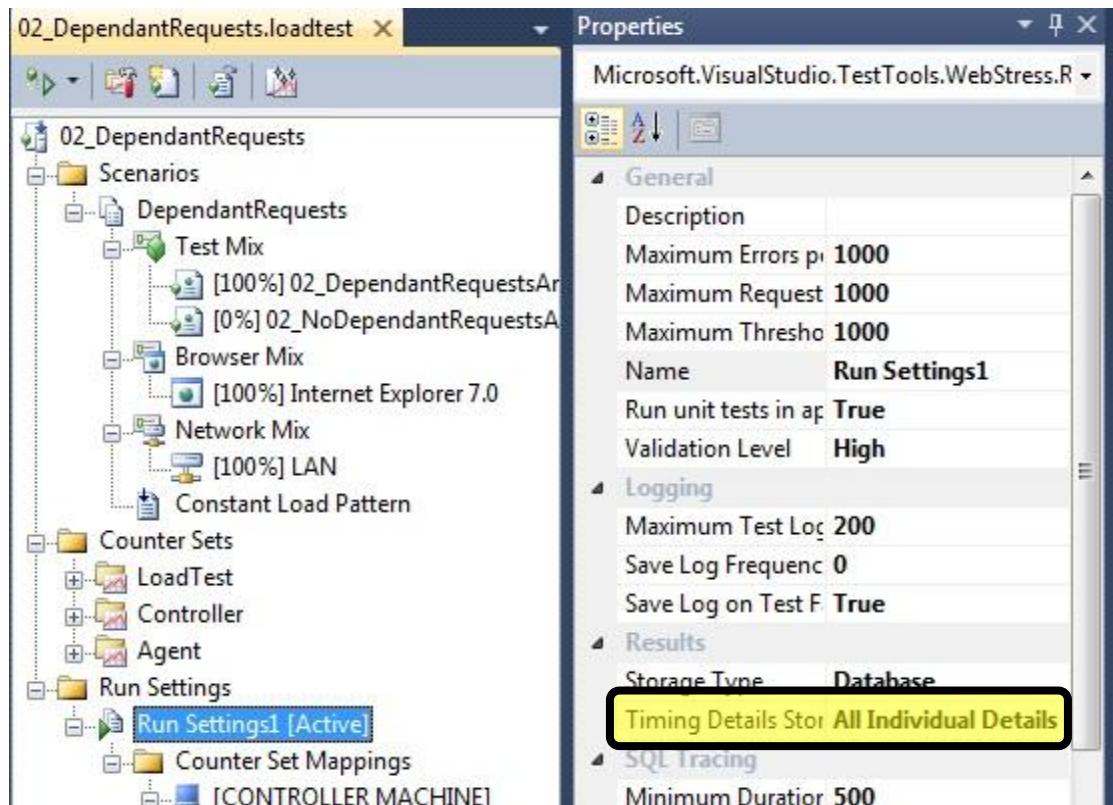
Requests			
Request	Scenario	Test	Total
CallWebService - Async Timer 1	ReportingName...	UpdatePanelTe...	6.00
CallWebService - Async Timer 2	ReportingName...	UpdatePanelTe...	6.00
CallWebService - random_string #1	ReportingName...	UpdatePanelTe...	6.00
CallWebService.aspx{GET}	ReportingName...	UpdatePanelTe...	6.00
CallWebService.aspx{POST}	ReportingName...	UpdatePanelTe...	30.0
global.gif	ReportingName...	UpdatePanelTe...	6.00
HOLHome.htm	ReportingName...	UpdatePanelTe...	6.00
ScriptResource.axd	ReportingName...	UpdatePanelTe...	9.00
WebResource.axd	ReportingName...	UpdatePanelTe...	3.00

The call from above with a reporting name

The calls from above without a reporting name. Even though they are the same requests, some have a GET method and some have a POST method.

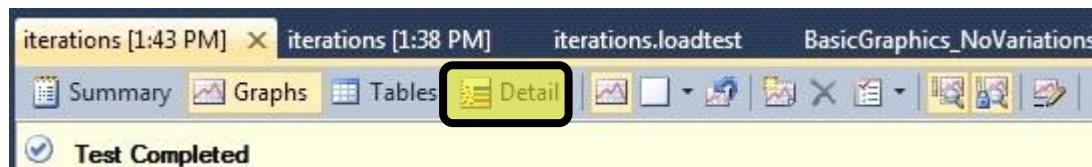
Virtual user visualization now available

NOTE: This feature is only available on tests where the “Timing Details Storage” property for the Run Settings is set to “All Individual Details”

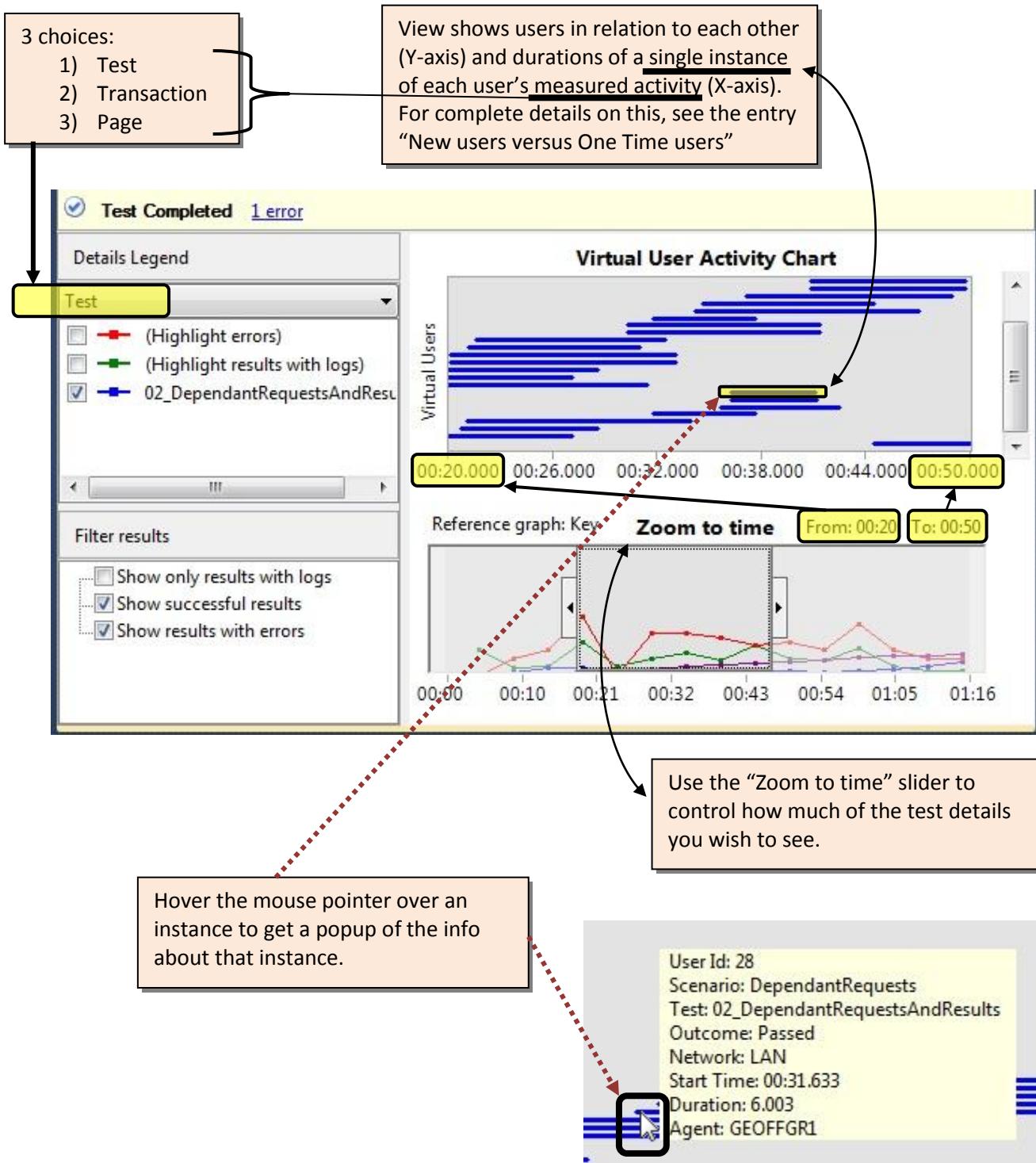


How to view activity visualization

In VSTS 2010, you can view a map of the virtual users activity AFTER a test run completes by clicking on the “Details” button in the results window.



What is shown in the visualization window



More Information

Here are the table definitions from the LoadTest2010 Results Store:

For the **LoadTestTestDetail** table, the big differences are that you get the outcome of the tests, which virtual user executed it, and the end time of the test.

```
[LoadTestRunId] [int] NOT NULL,  
[TestDetailId] [int] NOT NULL,  
[TimeStamp] [datetime] NOT NULL,  
[TestCaseId] [int] NOT NULL,  
[Elapsed Time] [float] NOT NULL,  
[AgentId] [int] NOT NULL,  
[BrowserId] [int],  
[NetworkId] [int],  
[Outcome] [tinyint],  
[TestLogId] [int] NULL, New to 2010  
[UserId] [int] NULL,  
[EndTime] [datetime] NULL,  
[InMeasurementInterval] [bit] NULL
```

For the **LoadTestPageDetail** table, you now get the end time of the page as well as the outcome of the page.

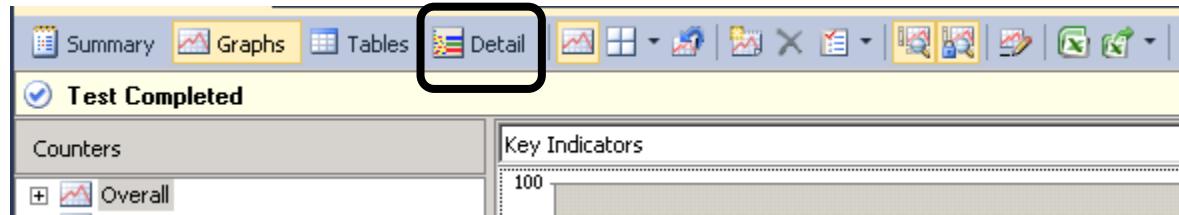
```
[LoadTestRunId] [int] NOT NULL,  
[PageDetailId] [int] NOT NULL,  
[TestDetailId] [int] NOT NULL,  
[TimeStamp] [datetime] NOT NULL,  
[PageId] [int] NOT NULL,  
[ResponseTime] [float] NOT NULL,  
[ResponseTimeGoal] [float] NOT NULL,  
[GoalExceeded] [bit] NOT NULL,  
[EndTime] [datetime] NULL, New to 2010  
[Outcome] [tinyint] NULL,  
[InMeasurementInterval] [bit] NULL
```

For the **LoadTestTransactionDetail** table the big changes are you get the response time of the transaction and the end time. Statistics for transactions such as Min, Max, Avg, Mean, StdDev, 90%, 95% and 99% are being calculated. These statistics are based on the **ResponseTime** column, not the **Elapsed Time**. The difference between the 2 is that elapsed time includes think time whereas the response time does not.

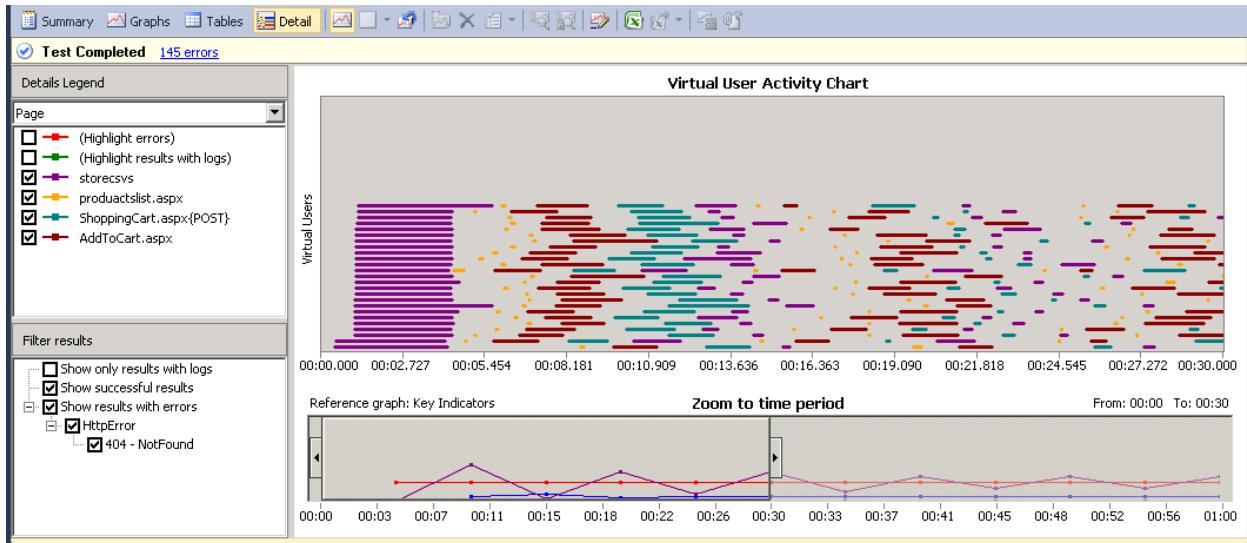
```
[LoadTestRunId] [int] NOT NULL,  
[TransactionDetailId] [int] NOT NULL,  
[TestDetailId] [int] NOT NULL,  
[TimeStamp] [datetime] NOT NULL,  
[TransactionId] [int] NOT NULL,  
[ElapsedTime] [float] NOT NULL,  
[EndTime] [datetime] NULL, New to 2010  
[InMeasurementInterval] [bit] NULL,  
[ResponseTime] [float] NULL
```

Another change in VS 2010 is that the default for whether or not to collect details has changed. In VS 2005 and VS 2008 the default was to not collect this detail data. In VS 2010, the default is to collect the detail data. This is controlled by the Timing Details Storage property on the Run Settings node in a load test.

So you can still run your own analysis on this data, but there is also a new view in VS that you can use to get a look at the data. The view is the Virtual User Activity Chart. When a load test completes, there will be a new button enabled on the load test execution toolbar. It is the detail button below:



When you click on this button you will be brought to the Virtual User Activity Chart. It looks like the following:

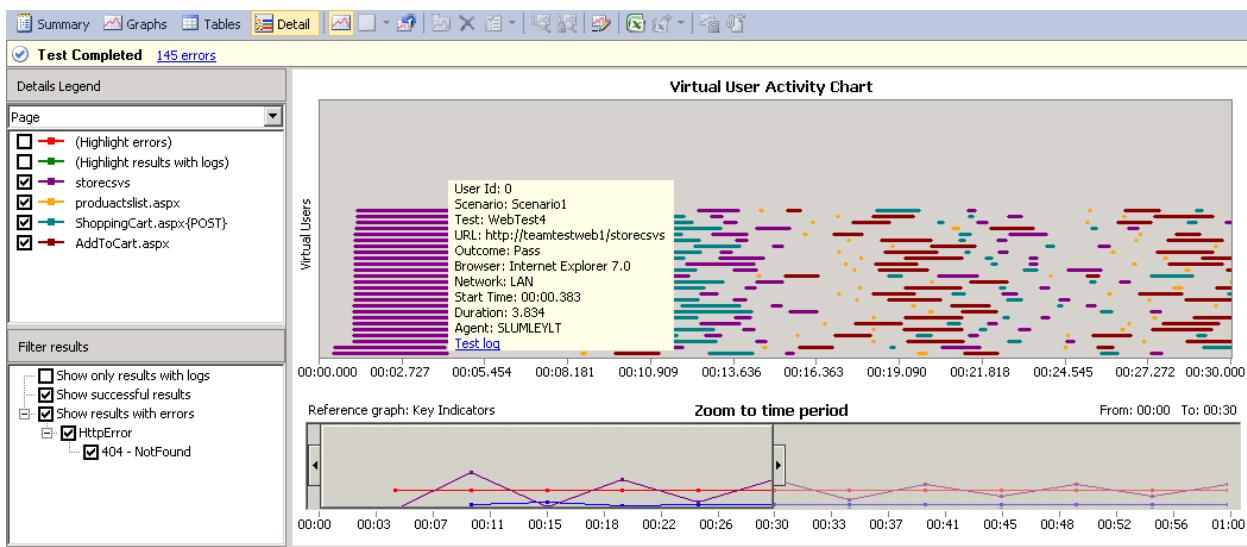


Here is what you are looking at. Each horizontal row represents a virtual user. Each line in a horizontal row represents a test, page or transaction. If you look at top left of this view, you will see a combo box that shows which type of detail you are looking at. So in my case this is showing pages. Each color represents a different page in the test. The length of the line represents the duration of the page. So you can quickly tell which pages are running long.

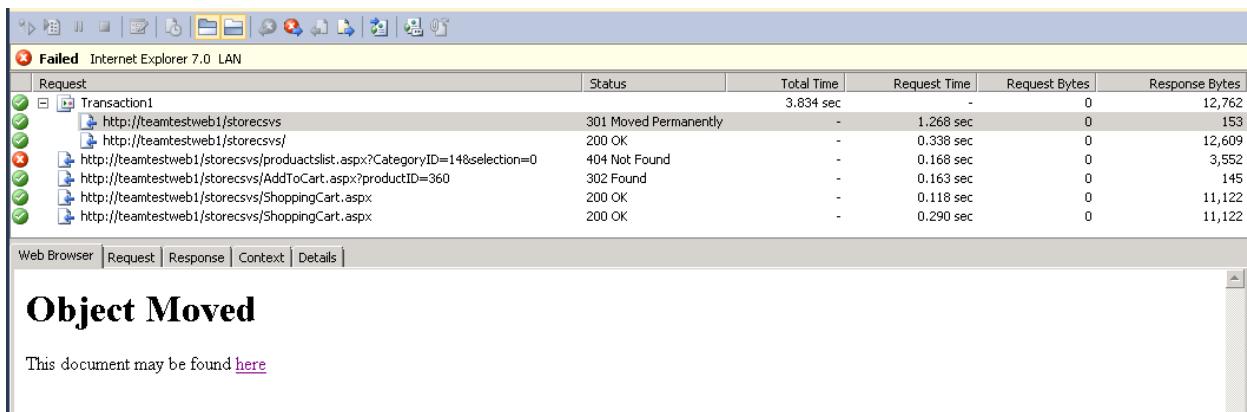
If you look at the bottom of the chart, you will see a zoom bar. The zoom bar allows you to change the range that you are looking at. The zoom bar overlays one of the graphs from the graph view. So whichever graph is selected in the graph view, you will see that on the zoom bar. This makes it very easy to correlate spikes in a graph with what tests/pages/transactions are occurring during that spike.

The legend on the left also has some filtering and highlight options. If you uncheck a page, then all instances of that page are removed from the chart. If you click to Highlight Errors, then all pages that failed will have their color changed to red. If you look at bottom part of the legend, you will see all the errors that occurred during the test. You can choose to remove pages with certain errors or remove all successful pages so you only see errors.

There is one other very useful feature of this view. You can hover over any line to get more information about the detail and possibly drill into the tests that the detail belongs to. For example this is what it looks like when you hover a detail:



You see information about user, scenario, test, url , outcome, etc. For this detail, there is also a test log link. If you click this, you will see the actual test that the page was a part of. For example, when I click test log, I see the following:



You see the full set of details collected for the test in the usual web test playback view that you are used to. If it was a unit test, you would have seen the unit test viewer instead.

New Excel reporting features built into load test results

There are two new features for reporting through Excel built into the load test results window

1) Load Testing Run Comparison Report

<http://blogs.msdn.com/slumley/archive/2009/11/07/vsts-2010-feature-load-testing-run-comparison-report-in-excel.aspx>

2) Load Test Trend Report

<http://blogs.msdn.com/slumley/archive/2009/05/22/dev10-feature-load-test-excel-report-integration.aspx>

New Load Test and Load Test Rig Licensing and configurations

This information was taken straight from a blog post by Ed Glas

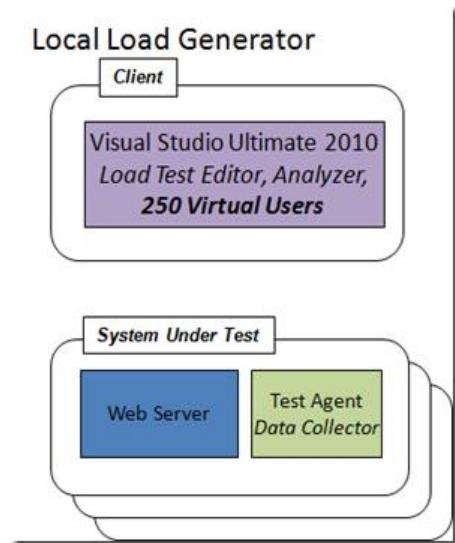
(<http://blogs.msdn.com/edglas/archive/2010/02/07/configuration-options-for-load-testing-with-visual-studio-2010.aspx>)

Using Visual Studio Ultimate enables you to generate 250 virtual users of load. To go higher than 250 users, you need to purchase a Virtual User Pack, which gives you 1000 users. You can use the 1000 users on any number of agents. Note that if you install the Virtual User Pack on the same machine as Visual Studio Ultimate, you do not get 1250 users on the controller. The 250 virtual users you get with Ultimate can only be used on “local” runs, not on a Test Controller. If you need to generate more 1000 users, you purchase additional Virtual User Packs, which aggregate or accumulate on the Test Controller. In other words, installing 2 Virtual User Packs on one controller gives you 2000 Virtual Users, which can be run on any number of agents.

Configuration 1: “Local” Load Generation

This is what you get when you install Visual Studio Ultimate, which is the ability to generate load “locally” using the test host process on the same machine that VS is running on. In addition to limiting load to 250 users, it is also limited to one core on the client CPU.

Note that purchasing Ultimate also gives you the ability to collect ASP.NET profiler traces by using a Test Agent as a data collector on the Web server.

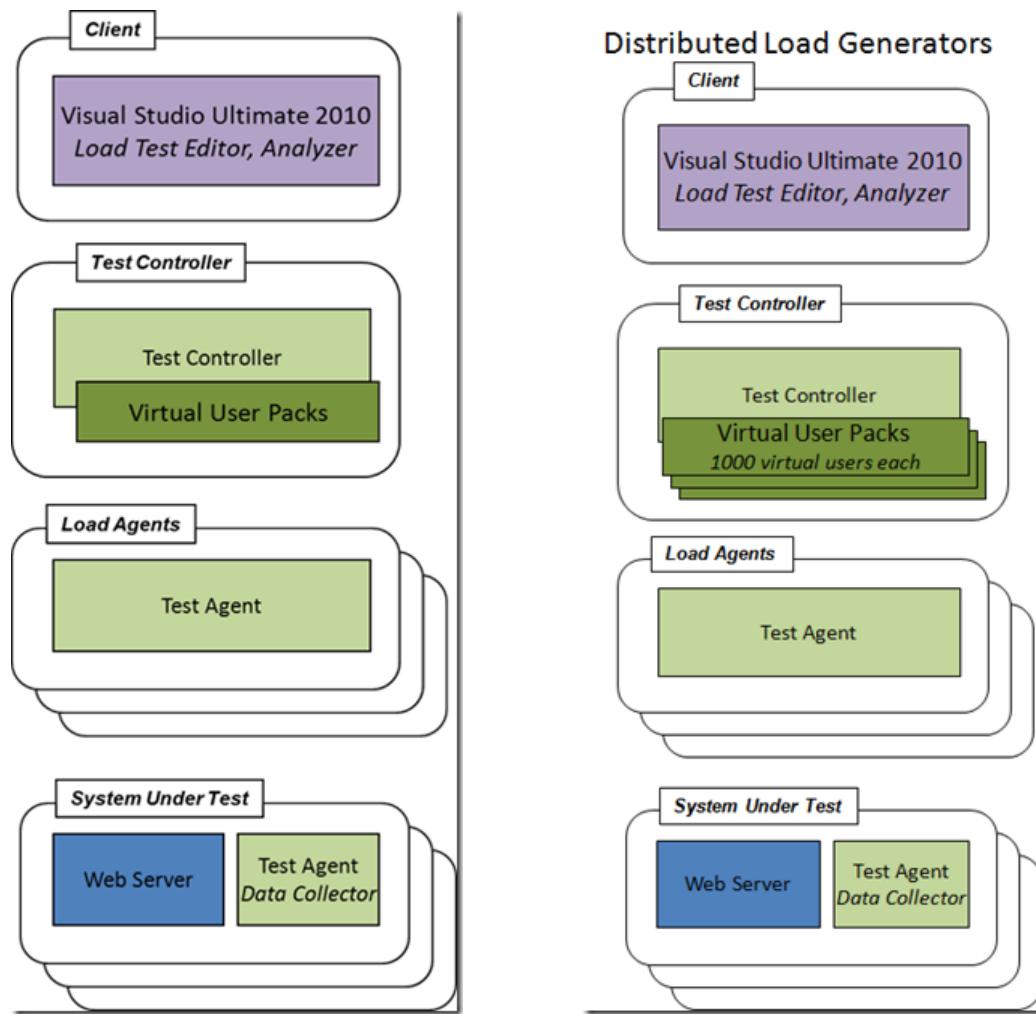


Configuration 2: Distributed Test Controller and Test Agents

This is a common configuration if you are scaling out your load agents. With this configuration, the Test Controller and each Test Agent is on a separate machine.

The advantage of this configuration is the controller is easily shared by team members, and overhead from the controller does not interfere with load generation or operation of the client.

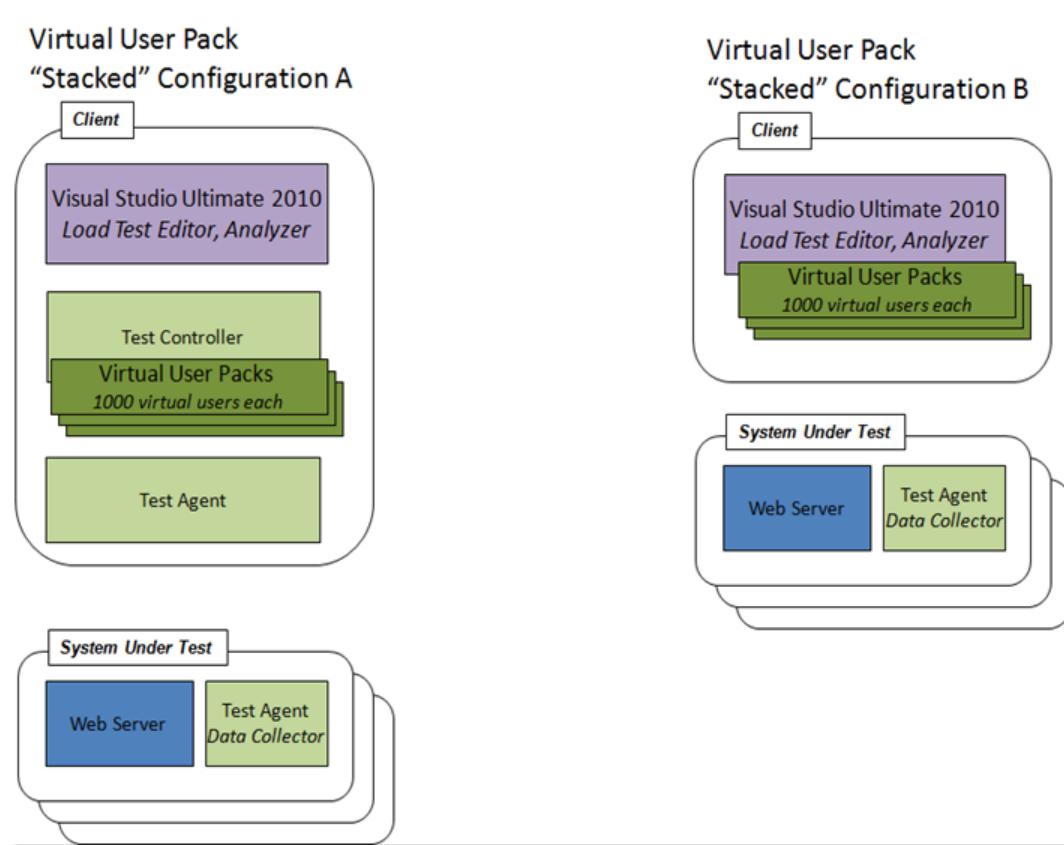
Note the Test Controller must have one or more Virtual User Packs installed to enable load testing. Load agents in this configuration always use all cores on the machine.



Configuration 3 A and B: Stacked Configuration

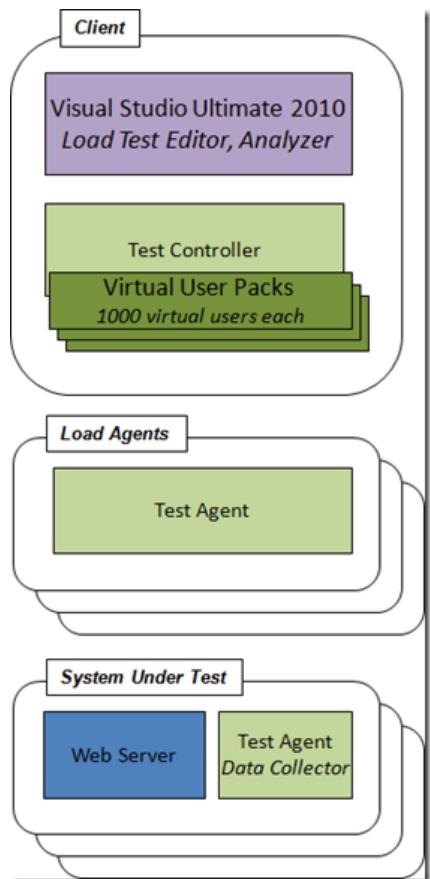
With configuration A, you install the Test Controller and Test Agent on the same machine as VS, then configure the Test Controller with Virtual User Packs. This enables you to generate >250 virtual users from the client machine, and unlocks all cores in the processor. Configuration B shows an alternative configuration, enabled if you configure the machine with Virtual User Packs using the VSTestConfig command line.

Note that a Virtual User Pack can only be used on one machine at a time, and configuring it on a machine ties it to that machine for 90 days. So you can't have the same Virtual User Pack installed on both the VS client and a separate machine running the Test Controller. See the Virtual User Pack license for details.



Configuration 4: Stacked Controller, Distributed Agents

In this configuration, the controller is running on the same machine as the Test client, with distributed agents running as load generators. This configuration is recommended if you have a solo performance tester. If your test controller and test agents will be shared by a team, we recommend running the controller on a separate box. Note that test agents are tied to a single test controller. You can't have two test controllers controlling the same agent.



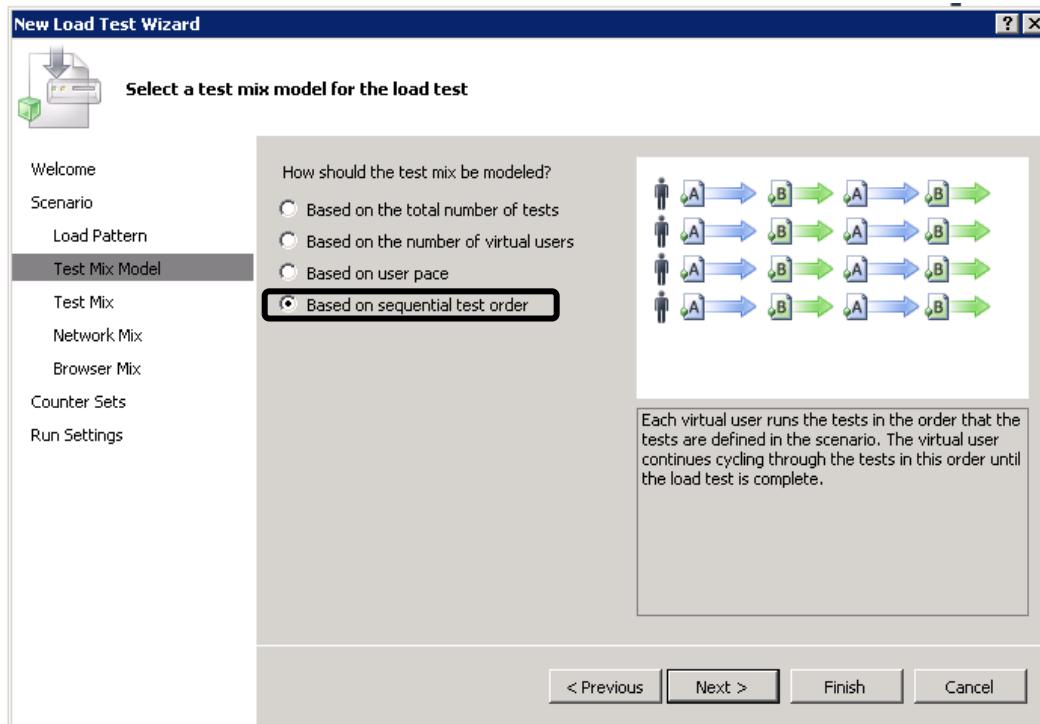
If you are using Visual Studio 2008, these options should look familiar to you as the VS 2008 load agents and controller offered the same configuration options. The new twist with VS 2010 is the Virtual User Packs, which offer you more flexibility in how you configure your load agents.

The Test Controller and Test Agent are “free” when you purchase Ultimate.

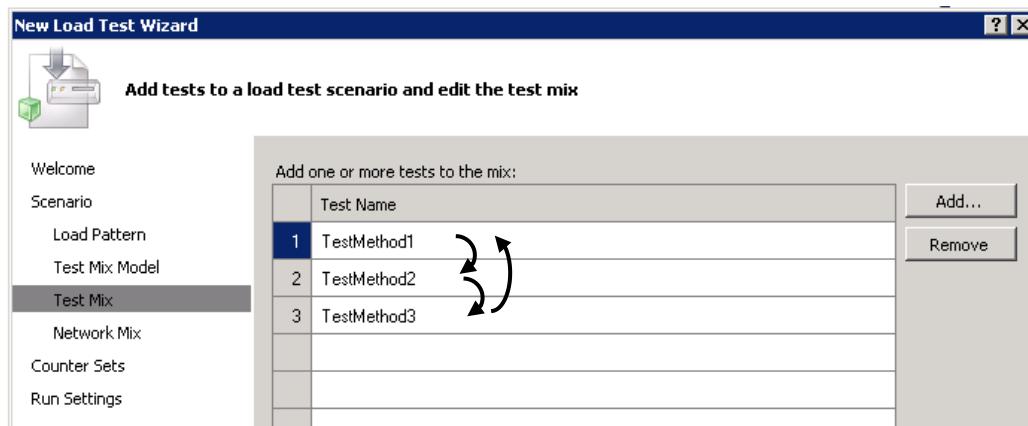
New test mix: “Sequential Test Mix”

It is not recommended to use ordered tests in a load test. In the load test results, you do not get the pass/fail results, test timings or transaction timings for any of the inner tests. You just get a Pass/Fail result and duration for the overall ordered test.

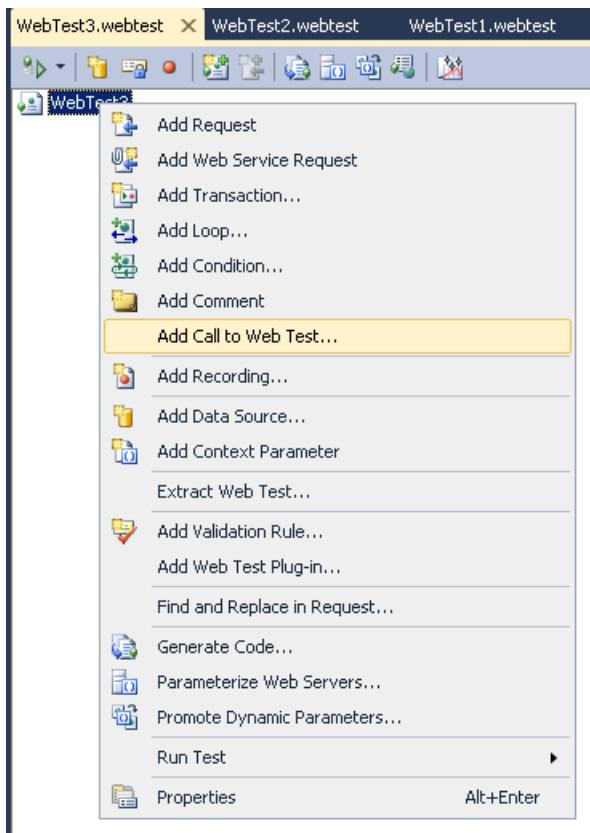
To address this issue, there is a new test mix type in VS2010 called Sequential Test Mix. Here is what it looks like in the load test wizard:



For this mix type, you set the order of tests that each virtual user will run through. You can mix web and unit tests in the mix and you will get the individual test, page and transaction results. When a virtual user completes the last test in the mix, it will cycle back to the first test in the mix and start over.



If you just want to control the order of web tests, you could also use a main web test that calls all of the tests in order as “nested tests”. This is called “**Web Test Composition**.” For example, suppose I have WebTest1 and WebTest2 and I want 1 to run before 2. I would create a third web test that has no requests, but references tests 1 and 2. To create this kind of test, first record web tests 1 and 2. Then add a third web test and just hit stop in the web test recorder. When you are back in the web test editor, right click on the root node and select “Add Call to Web Test...”



This will launch a dialog and then select WebTest1. Then do same steps and add WebTest2. Now just run WebTest3 and you will execute both tests. WebTest composition has been available since VS2008

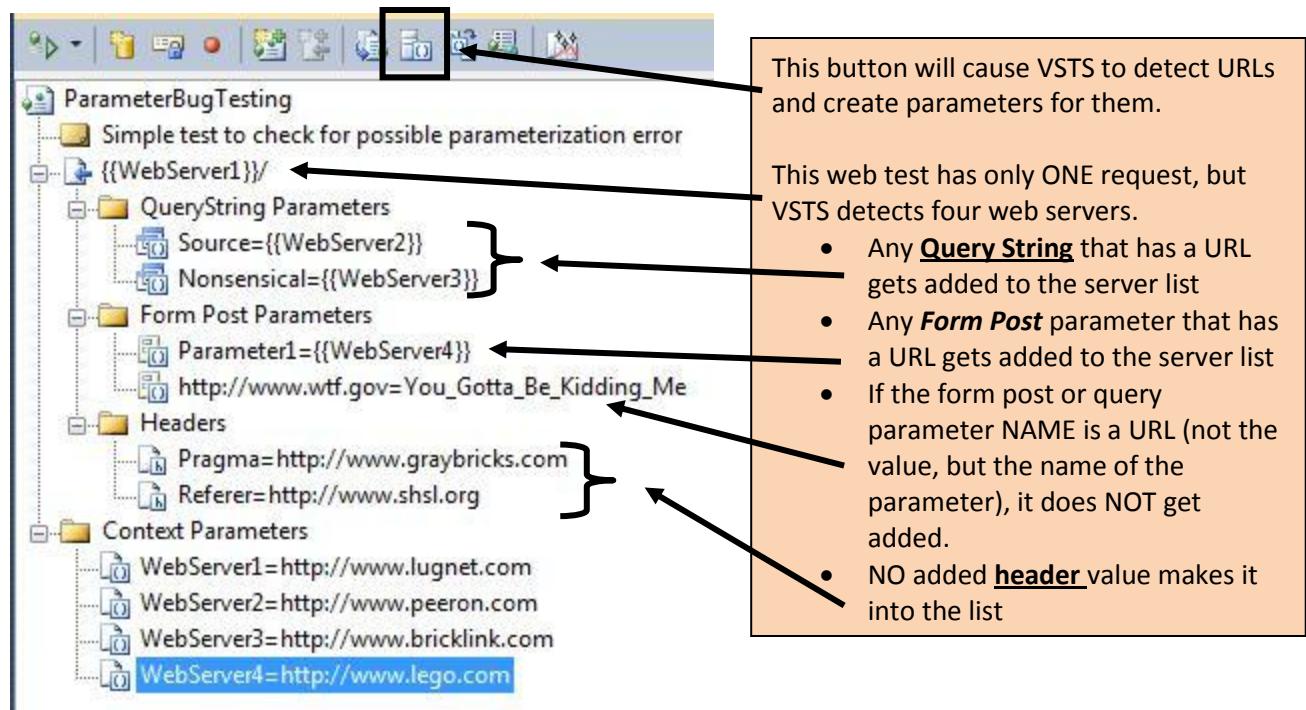
Query String and FORM POST URLs get parameterized

When you choose to parameterize the web servers in a web test, you may see more webservers listed than your test actually calls. This is expected behavior.

that the parameter parser is finding websites that reside inside query strings. Notice this in the .webtest file:

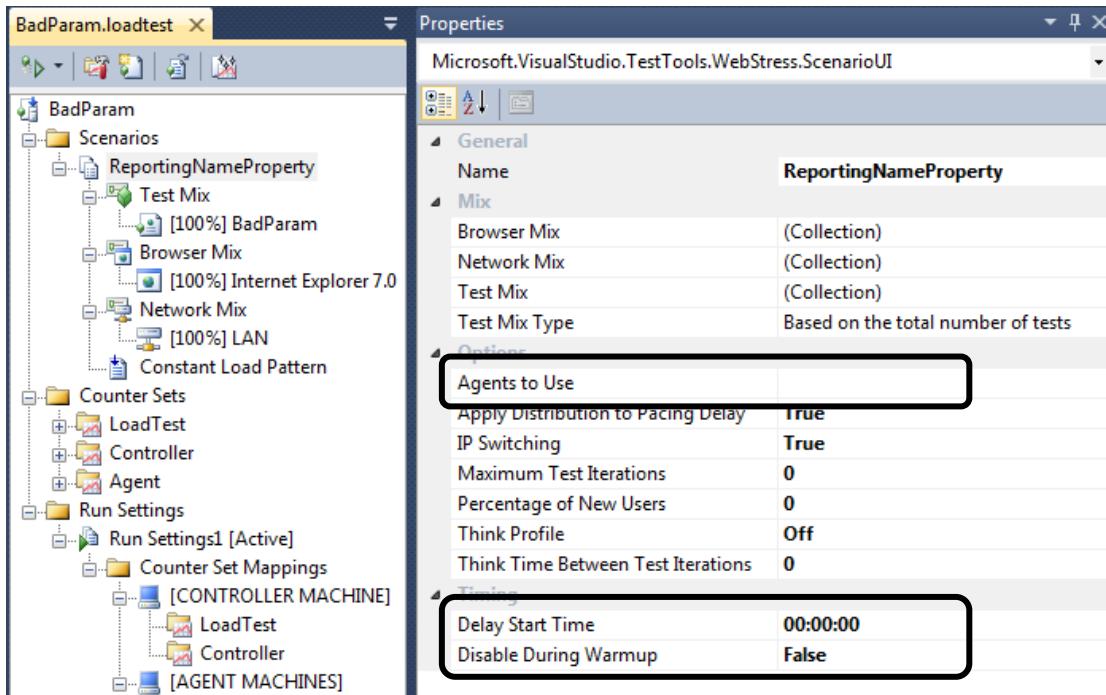
```
<QueryStringParameter Name="Source"
Value="http%3A%2F%2Flocalhost%3A17012%2Fdefault%2Easpx"
RecordedValue="http%3A%2F%2Flocalhost%3A17012%2Fdefault%2Easpx" CorrelationBinding=""
UrlEncode="False" UseToGroupResults="False" />
```

- Any **Query String** that has a URL gets added to the server list
- Any **Form Post** parameter that has a URL gets added to the server list
- NO added **header** value makes it into the list
- If the form post or query parameter NAME is a URL (not the value, but the name of the parameter), it does NOT get added.



New options on Load Test Scenarios

There are some new properties exposed for load test scenarios that make it easier to control how your tests run.



Agents to Use

The agent names that are entered should be the names of agents that are connected to the controller to which the load test will be submitted. They should be the simple computer names of the agents (as seen in the “Computer Name” field in the Control Panel). **Unfortunately, at this time, if you switch to submitting the load test to a different controller, you will need to change the value for “Agents to Use” as there is no way to parameterize this list to vary depending on the controller used.** This list of agents designates a subset of those the agents that are connected to the controller, and are in the Ready state when the load tests starts (they may be running a different load test or other test run when the load test is queued as long as they become Ready when the load test is taken out of the Pending state and starts running), and that meet any agent selection criteria to allow the test run to be run on the agent. The Scenario will run on all agents in the list that meet these criteria, and the user load for the Scenario will be distributed among these agents either evenly (by default) or according to any agent weightings specified in the Agent properties for the agents (from the “Administer Test Controllers” dialog in Visual Studio).

Delay Start Time

Amount of time to wait after the load test starts before starting any tests in this scenario.

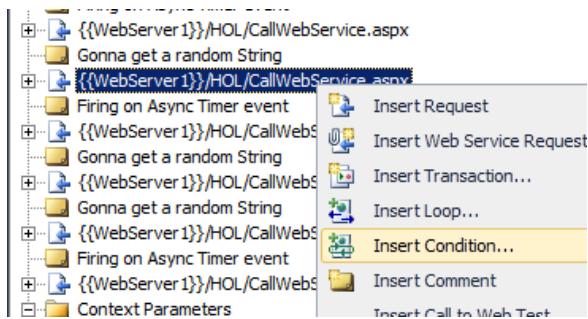
Disable During Warmup

If true, the delay time does not begin until after warmup completes.

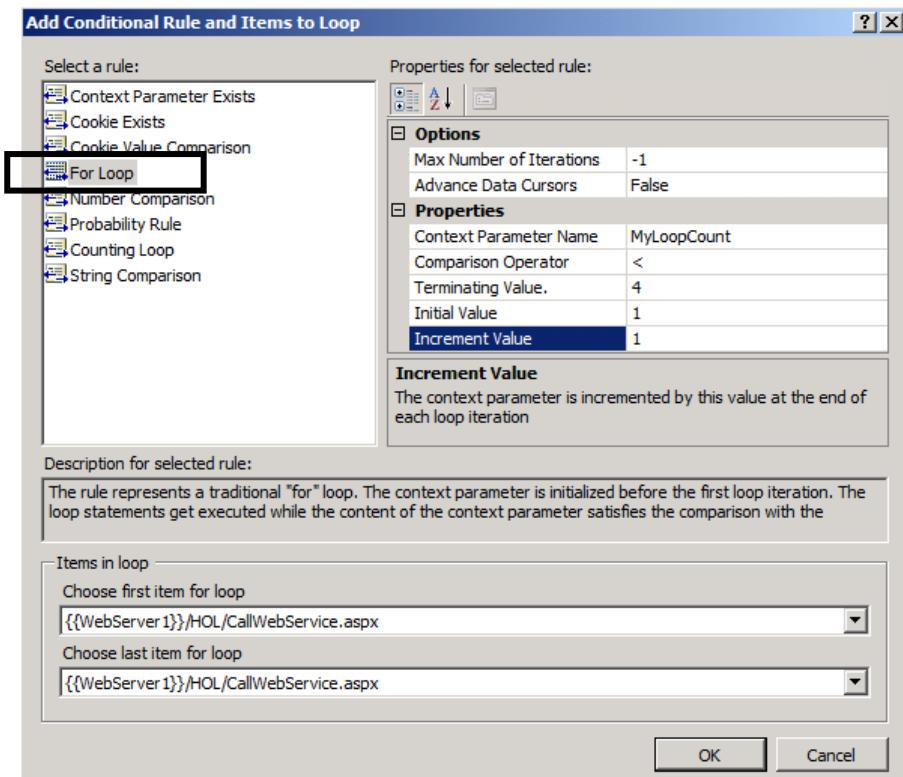
Loops and Conditionals

In Visual Studio 2008, if you wanted to conditionally execute some requests or you wanted to loop through a series of requests for a given number of times, you had to convert a declarative web test to a coded web test. In VS2010, these options are exposed directly in declarative webtests.

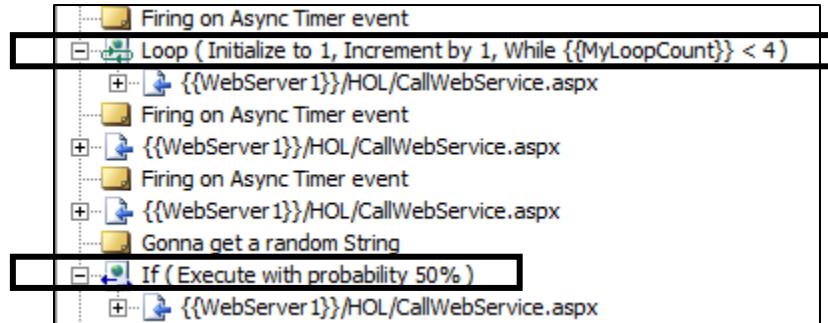
The ability to add these are exposed by right-clicking on a request and selecting the option you want from the context menu:



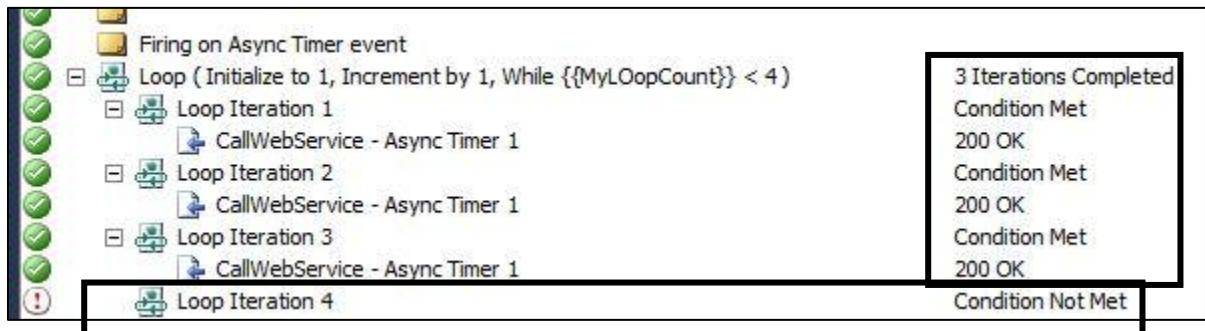
The context menu showing the loop and condition insert options



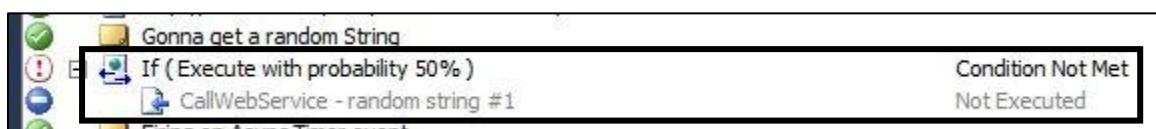
Sample dialog box for setting the properties of a loop



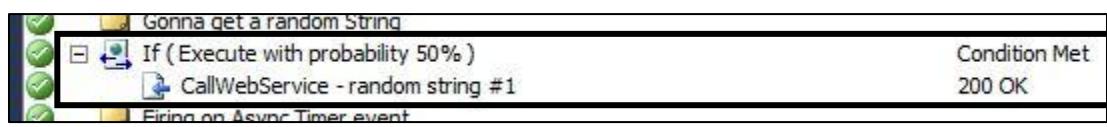
What the entries look like in the declarative test



Loop results when the test is played back



What results look like if a conditional call fails



What the results look like if a conditional call succeeds.

Configurations and Settings

How to Change the Location Where Agents Store Run Files

If you need to move the location that an agent uses to store the files downloaded to it for executing tests, the following steps will take care of this. On each agent machine,

- Open QTAgentService.exe.config
- Add "<add key="WorkingDirectory" value="**<location to use>**" />" under the <appSettings> node.
- Create the **<location to use>** folder.

How to set a proxy server for web tests

By default, there is no proxy set on a web test, so it doesn't matter what the Internet Explorer® ("IE") proxy settings are. If your test sets a specific proxy server within the web test then the IE setting is still not used. In coded web tests or web test plug-ins, you can set the proxy name using the WebProxy property of the WebTest class. **NOTE that this method is broken in Visual Studio Team Test ("VSTT") 2008 RTM, but is fixed in SP1 for VSTT 2008.**

If you wish to use the machine's IE proxy settings then you can set the Proxy property to "**default**" (without the quotes). In this case you should turn off Automatic Proxy Detection on each agent.

Automatic Proxy detection is very slow and can greatly impact the amount of load you can drive on an agent.

How to configure Web Tests so Fiddler can capture playback info

Changed in 2010

In 2008

By default, web test playback ignores proxy servers set for localhost, so enabling a proxy for 127.0.0.1 (which is where Fiddler captures) will not result in any captured data. To make this work, either add a plugin with the following code, or put the following code in the Class constructor for a coded web test:

```
this.Proxy = "http://localhost:8888";
WebProxy webProxy = (WebProxy)this.WebProxy;
webProxy.BypassProxyOnLocal = false;
```

In 2010

To get fiddler to work in VS 2010, simply open Fiddler, then start playing the web test. There is no need to code for anything.

Controlling the amount of memory that the SQL Server Results machine consumes

The default behavior for SQL Server is to consume as much memory as it thinks it can, the workload on the machine may not be allowing SQL Server to correctly identify memory pressure and hence give back some memory. You can configure SQL Server to a max memory limit, which if all you are doing is inserting results should be fine.

The below is how you can set memory to 512mb. The size of the memory you use will vary based on the machine, testing and how much memory you have.

```
sp_configure 'show advanced options', 1
RECONFIGURE
GO
sp_configure 'max server memory', 512
RECONFIGURE
GO
```

How to configure the timeouts for deployment of load tests to agents

The file to change is "Microsoft Visual Studio 9.0\Xml\Schemas\vstst.xsd". look for the run config schema. Then search for "timeout":

```
<xs:element name="Timeouts" minOccurs="0">
  <xs:complexType>
    <xs:attribute name="runTimeout" type="xs:int" use="optional"
default="0"/>
    <xs:attribute name="testTimeout" type="xs:int"
use="optional" default="1800000"/>
    <xs:attribute name="agentNotRespondingTimeout" type="xs:int"
use="optional" default="300000"/>
    <xs:attribute name="deploymentTimeout" type="xs:int"
use="optional" default="300000"/>
    <xs:attribute name="scriptTimeout" type="xs:int"
use="optional" default="300000"/>
  </xs:complexType>
</xs:element>
```

Change the values as needed and note that the time is in milliseconds.

How to set the number of Load Test Errors and Error Details saved

Load Test Errors:

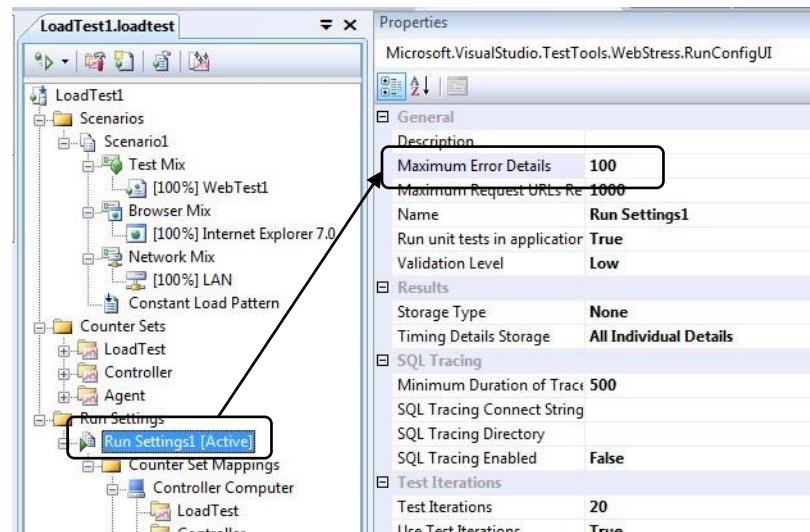
You can change the total number of errors stored for a run in the appropriate configuration file (depending on whether this is for local runs or for test rig runs):

Version	Run Type	File Name	Location
2008	Local	VSTestHost.exe.config	<Program Files>\Microsoft Visual Studio 9\Common7\IDE\
2008	Remote	QTController.exe.config	<Program Files>\Microsoft Visual Studio 9.0 Team Test Load Agent\LoadTest\
2010	Local	DevEnv.exe.config	<Program Files>\Microsoft Visual Studio 9\Common7\IDE\
2010	Remote	QTController.exe.config	<Program Files>\Microsoft Visual Studio 9\Common7\IDE\

Add a key to the "appSettings" section of the file (add the "appSettings" section if needed) with the name "LoadTestMaxErrorsPerType" and the desired value.

```
<appSettings>
    <add key="LoadTestMaxErrorsPerType" value="5000"/>
</appSettings>
```

Load Test Error Details:



Multi-proc boxes used as agents should have .NET garbage collection set to server mode

Changed in 2010

In 2008

To enable your application to use Server GC, you need to modify either the **VSTestHost.exe.config** or the **QTAgent.exe.config**. If you are not using a Controller and Agent setup, then you need to modify the **VSTesthost.exe.config**. If you are using a controller and agent, then modify the **QTAgent.exe.config** for each agent machine. Open the correct file. The locations are

VSTestHost.exe.config - C:\Program Files\Microsoft Visual Studio 9.0\Common7\IDE
QTAgent.exe.config - C:\Program Files\Microsoft Visual Studio 9.0 Team Test Load Agent\LoadTest

To enable gcserver you need to add the following highlighted line in the runtime section:

```
<?xml version ="1.0"?>
<configuration>
    <runtime>
        <gcServer enabled="true" />
        <assemblyBinding xmlns="urn:schemas-microsoft-com:asm.v1">
            <probing
privatePath="PrivateAssemblies;PublicAssemblies"/>
        </assemblyBinding>
    </runtime>
</configuration>
```

In 2010

The agent service in VS 2010 is now set to Server GC by default. No need to take any action here.

Location of list of all agents available to a controller

Changed in 2010

To retrieve a list of agents assigned to a controller without using the VSTS IDE, look in:

In 2008

<install point>\Microsoft Visual Studio 9.0 Team Test Load Agent\LoadTest\QTControllerConfig.xml

In 2010

<install point>\Microsoft Visual Studio 10.0\Common7\IDE\QTControllerConfig.xml

Networks, IP Switching, Test Startups

IP Address Switching anatomy (how it works)

Each agent is assigned a range of up to 256 IP addresses to use. At the start of a test run, the agent service configures the IP addresses on the network card. When the test starts running, new connections are round-robin through the pool of IP addresses.

The most common use for IP Switching is when load testing against a load balancer. Load balancer typically use the IP address to route requests to a particular Web server in the farm. So if you have 2 agents driving load to 3 Web servers, since all traffic is coming from two IPs (one on each agent), only two of the web servers would get all the traffic. IP Switching provides a way to have traffic come from multiple IPs on the same agent, enabling the load balancer to balance load across the farm.

VSTT currently limits the number of unique IP addresses to 256 per agent. In most testing situations, this will be plenty of addresses. The main place where this limitation might impact you is if you are running a large test where every single user must have a separate IP Address for some sort of session state. This is pretty unusual.

In VS 2008, there is no way to have a given virtual user use the same IP. That is, with IP switching turned on, a given user will multiple IPs out of the IP pool, and may use different IPs on subsequent iterations.

In VS 2010, the Web test engine tries to ensure that the same user will always use the same IP address, but there is no guarantee that it will be the case.

The biggest problem with assigning unique IP Addresses to every user is that currently the IP switching configuration limits you to a range of 256 IP addresses per agent, which would mean you would also be limited to 256 virtual users per agent. One solution is to use VMs to get multiple load test agents on a single physical machine.

Gotcha: IP Address Switching is ONLY for WEB TESTS

The IP Switching feature will NOT work with Unit Tests

Gotcha: IP Addresses used for switching are not permanent

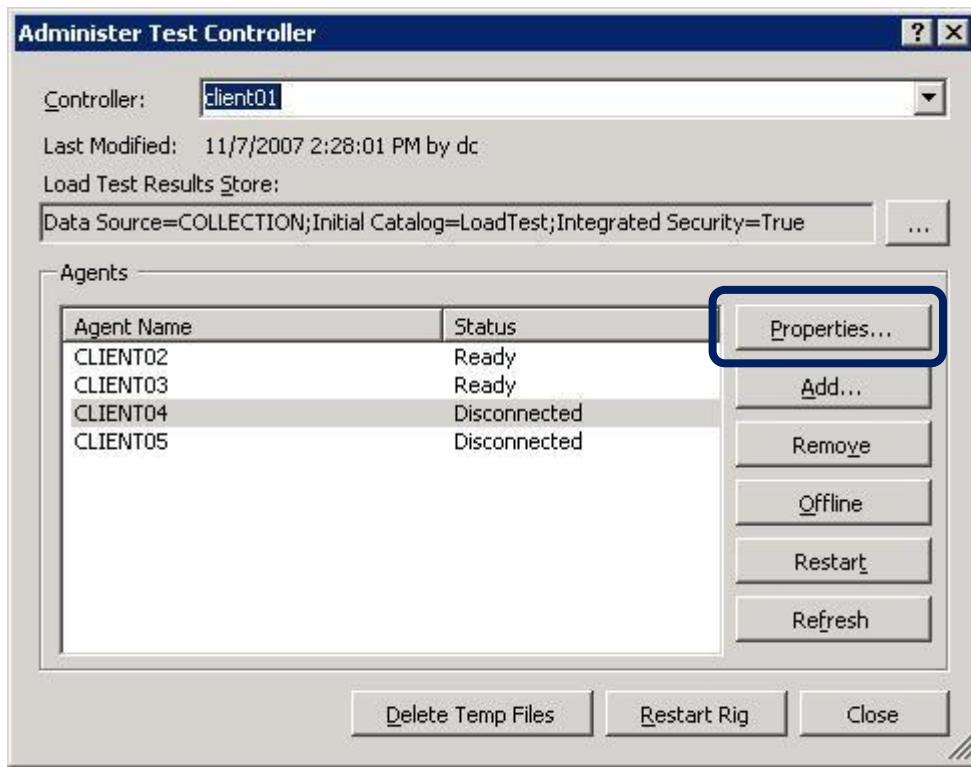
When you choose to use multiple IP addresses from each agent machine during load testing (known as IP address switching or spoofing), most testing tools require you to add those IP addresses to the NIC of the machine, and they are always available and always show up on the machines. VSTS allows you to set a range of IP addresses directly in the test project. Then VSTS dynamically adds the addresses to the agent(s) when the test run starts, and removes them when the test run stops.. If you need to perform IP switching, a controller/agent setup is required.

How to Setup IP Switching

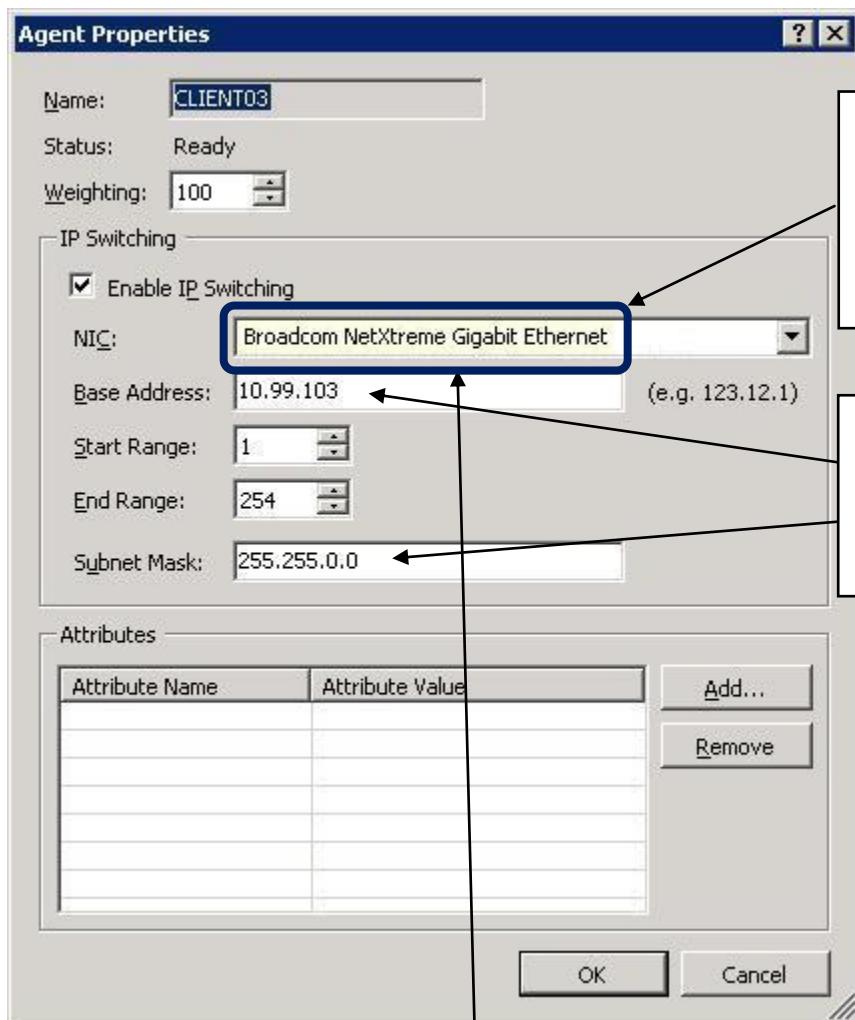
There are 2 parts to setting up IP Switching. First, you must configure the Test Rig Agents to use IP Switching. Then you must tell the Load Test itself that it should take advantage of that. Here are the steps and the pitfalls involved:

Setting up the agents

1. Open up the Test Rig Administration dialog (Test -> Administer Test Controller)
2. Highlight each of the agents and bring up the Properties for the agent
3. Fill out all of the appropriate information (as outlined in the picture below)

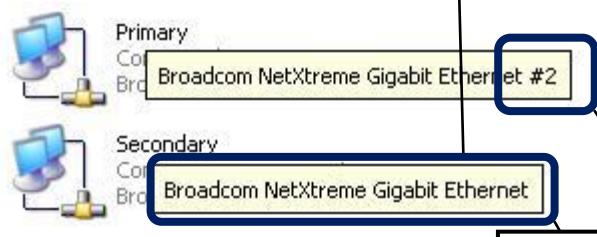


Where to configure Agent Properties



Make sure you pick the correct adapter here. Use the Network Connections properties built into Windows along with the IPCONFIG command to see which NIC is assigned to what subnet (see below).

The base address is 3 octets and should be representative of the subnet you are on. If you are using a class B subnet, you still need a third octet for the base.



The output from the IPCONFIG command in a CMD window.

The information as shown in the Network Connections dialog box in Windows. You may need to hover the mouse over the NIC to see the entire

Getting the proper IP Address info for spoofing

```
C:\Documents and Settings>ipconfig

Windows IP Configuration

Ethernet adapter Secondary:

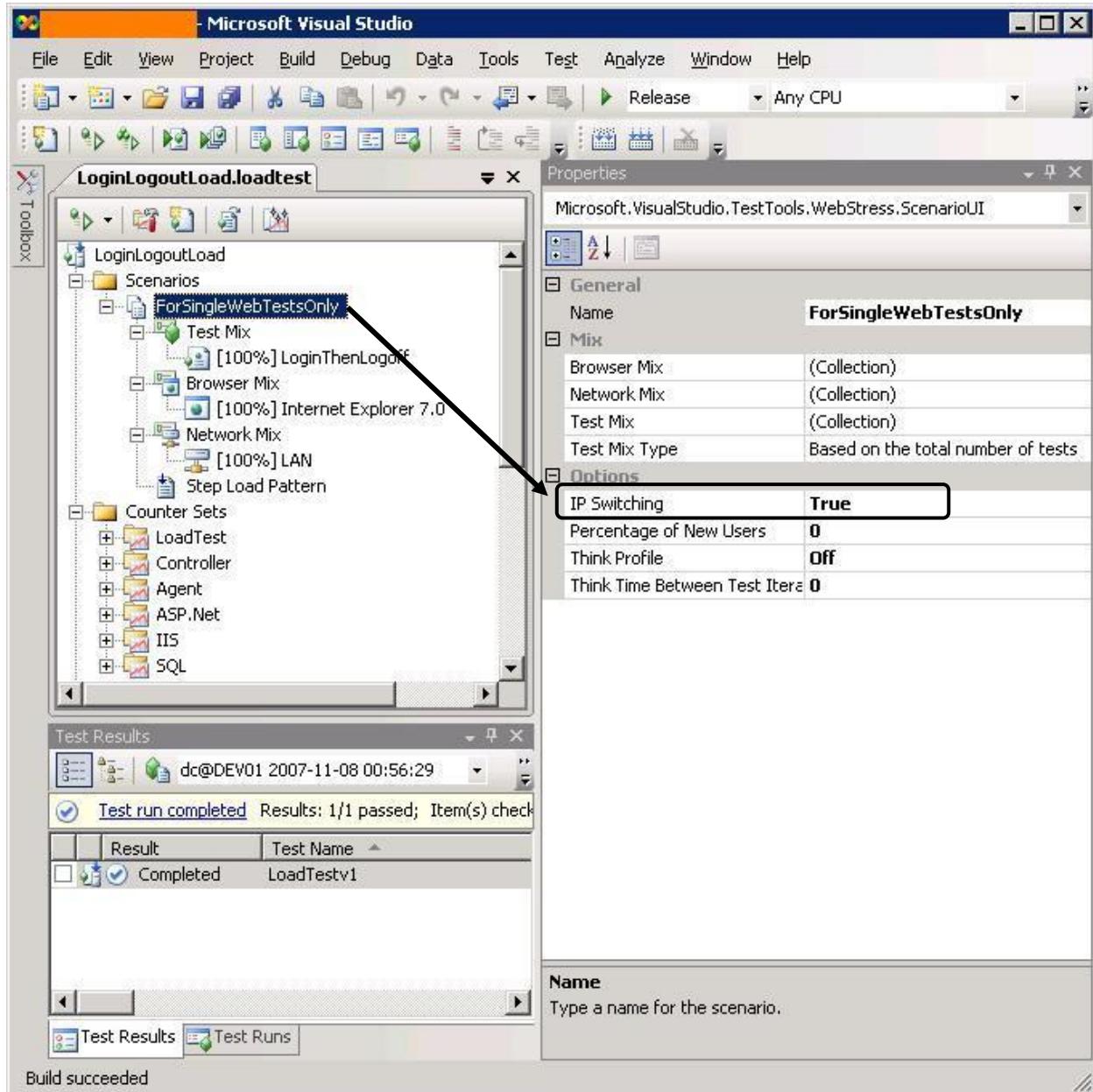
Connection-specific DNS Suffix . :
IP Address . . . . . : 10.69.200.3
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.69.0.1

Ethernet adapter Primary:

Connection-specific DNS Suffix . :
IP Address . . . . . : 10.99.3.3
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.99.0.1
```

Setting up The Load Test

Once the test rig is setup, you can configure which Load Test will actually use IP Switching by setting the correct property for the Load Test:



Where to enable IP Switching for the Load Test Itself (after configuring the agents to use it)

Troubleshooting invalid view state and failed event validation

ASP.NET uses __VIEWSTATE and __EVENTVALIDATION hidden fields to round-trip information across HTTP requests. The values for these fields are generated on the server and should be posted unchanged on a post back request. By default, these values are signed with a so-called validationKey to prevent tampering with the values on the client.

If you just record the values in a web test and post the recorded values, you can run into ASP.NET error messages about invalid view state or failed event validation. The Visual Studio web test recorder will normally automatically detect the __VIEWSTATE and __EVENTVALIDATION hidden fields as dynamic parameters. This means the dynamically extracted values will be posted back instead of the recorded values.

However, if the web server is load balanced and part of a web farm you may still run into invalid view state and failed event validation errors. This occurs when not all servers in the web farm use the same validationKey and the post back request is routed to a different server in the farm than the one on which the page was rendered.

To troubleshoot, ViewState MAC checking can be disabled by setting enableViewStateMac to false. However, this is not suitable for use on a production environment because it disables an important security feature and has performance implications. The recommended fix is to define the same value for the validationKey on all machines.

Instructions for manually creating a validationKey are detailed at <http://msdn.microsoft.com/en-us/library/ms998288.aspx>. For IIS 7 a machine key can easily be created through IIS Manager, see [http://technet.microsoft.com/en-us/library/cc772287\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc772287(WS.10).aspx).

For more background information on ViewState and EventValidation go to <http://msdn.microsoft.com/en-us/magazine/cc163512.aspx>.

Startup: Slowness Restarting a Test Rig with Agents Marked as “Offline”

If you have agent machines that are either disabled (powered off, service stopped, etc) or that no longer exist, but you only mark them as “Offline” in the “Administer Test Controllers” dialog, restarting the rig will take a long time. The controller will attempt to contact all agents listed in the dialog regardless of their status, and it will take approximately one minute or more for each missing machine.

Startup: Multiple Network Cards can cause tests in a rig to not start

Problem: When running tests against a controller and test agents the tests start with pending state but then nothing else happens.

Visual Studio Client Resolution: The problem is that you have two network adapters on the client machine. The following entries in the controller log confirm that this is the problem:

```
[I, 2972, 11, 2008/06/26 13:02:59.780] QTController.exe: ControllerExecution: Calling back to client for deployment settings.
```

```
[E, 2972, 11, 2008/06/26 13:06:51.155] QTController.exe: StateMachine(RunState): Exception while handling state Deploying: System.Net.Sockets.SocketException: A connection attempt failed because the connected party did not properly respond after a period of time, or established connection failed because connected host has failed to respond 65.52.230.25:15533
```

This is exactly the type of error message we see when the controller communication with Visual Studio fails because the client has network cards: To configure your Visual Studio installation to communicate with the controller, try this:

In regedit:

- Find the key:
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\VisualStudio\9.0\EnterpriseTools\QualityTools
- Add a new key under the above key named “ListenPortRange”
- In the key “ListenPortRange”, add a new string value with the name “BindTo” and the IPv4 address for the client (65.52.230.25 in your case) as the BindTo value.

Test Rig Resolution:

Read the following support article for the steps to resolve this issue on a test rig:

<http://support.microsoft.com/kb/944496>

Startup: Slow startup can be caused by _NT_SYMBOL_PATH environment variable

If you have the environment variable _NT_SYMBOL_PATH defined on your systems, your tests may stay in the “pending” state for a long time. This happens whenever the symbol path defines a symbol server that is external to your environment and you do not have a local cache of symbols available. To work around this, do the following:

1. Remove the _NT_SYMBOL_PATH in the environment where you start devenv.exe from.
2. Change _NT_SYMBOL_PATH, by putting a cache location in front of the symbol store location.

For more information about symbol paths and symbol servers, go to:

[http://msdn.microsoft.com/en-us/library/ms681416\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/ms681416(VS.85).aspx)

Startup: tests on a Rig with Agents on a Slow Link

The load test does not actually start on any agents until deployment of all files has occurred to all agents (by the way, this means that the slow up start of a load test on a rig with many agents could have been caused by slow deployment to one or more agents).

A common **root cause** is the _NT_SYMBOLS_PATH variable defined in the environment that points to somewhat slow symbol server (like <\\symbols\\symbols>).

Try one these workarounds:

- Undefine _NT_SYMBOLS_PATH in the environment where you start devenv.exe from.
- Change _NT_SYMBOLS_PATH, by putting a cache in front, such as cache*c:\sympcache. This is will make 1st run same slow but all subsequent runs fast.

“Not Bound” Exception when using IP Switching is not really an error

New to 2010

The below error may appear several times when running a load test where you are using IP Switching. In most cases, this can be ignored.

```
00:51:35      AGENT02      <none>      <none>      <none>      Exception
LoadTestException      151 Web test requests were not bound to either the correct IP
address for IP switching, or the correct port number for network emulation, or both.
```

The one situation where the presence of this error may indicate a real issue with the test is when the application is relying on a given iteration to always come through on the same IP address for purposes of maintaining a session (such as a load balancer like Microsoft ISA Server with the IP Sticky setting turned on).

How to configure the timeout for deployment of load tests to agents

Changed in 2010

You might encounter timeouts when deploying load tests to agents when the deployment contains many or large files. In that case you can increase the timeout for deployment. The default value is 300 seconds.

In 2010

You have to change the **.testsettings** file that corresponds to your active test settings in Visual Studio, because the deployment timeout setting is not exposed via the Visual Studio UI. Check via the menu Test | Select Active Test Settings (Visual Studio 2010) which file is active. You can find the file in the Solution Items folder of your solution. Open it in the XML editor, by right clicking it, choosing “Open With...” and selecting “XML (Text) Editor”.

The **TestSettings** element will have an **Execution** element. Add a child element called **Timeouts**, if not already present, to the **Execution** element. Give it a **deploymentTimeout** attribute with the desired timeout value in milliseconds. For example:

```
<?xml version="1.0" encoding="UTF-8"?>
<TestSettings name="Controller" id="330da597-4a41-4ae7-8b95-60c32ab793fb"
  xmlns="http://microsoft.com/schemas/VisualStudio/TeamTest/2010">
  ...
  <Execution location="Remote">
    <Timeouts deploymentTimeout="600000" />
```

IntelliSense should help you out when adding/editing this.

In 2008

In 2008 you have to change the **.testrunconfig** file that corresponds to your active test run configuration,

Add a child element **Timeouts** under the **TestRunConfiguration** element if no such element is already present. Check via the menu Test | Select Active Test Run Configuration which file is active. You can find the file in the Solution Items folder of your solution. Give it a **deploymentTimeout** attribute with the desired timeout value in milliseconds. For example:

```
<?xml version="1.0" encoding="UTF-8"?>
<TestRunConfiguration name="Controller" id="af5824b3-56fa-4534-a3f8-6e763a56869a"
  xmlns="http://microsoft.com/schemas/VisualStudio/TeamTest/2006">
  <Timeouts deploymentTimeout="600000"/>
```

IntelliSense should help you out when adding/editing this.

Performance Counters and Data

Customizing the Available Microsoft System Monitor counter sets

The counter set templates for VSTS are located in the following directory (assuming a typical install):

In 2008

C:\Program Files\Microsoft Visual Studio
9.0\Common7\IDE\Templates\LoadTest\CounterSets

In 2010

C:\Program Files\Microsoft Visual Studio
10.0\Common7\IDE\Templates\LoadTest\CounterSets

These files are standard XML files and can be modified to allow for quick and easy re-use of custom sets. It is recommended that you copy the counter set you wish to enhance and add the name CUSTOM to it so you will always remember that it is a custom counter set. Or you can create your own totally independent counter set. The following shows the layout of the file:

```

<?xml version="1.0" encoding="utf-8"?>
<CounterSet Name="Custom" CounterSetType="Custom Set">
  <CounterCategories>
    <CounterCategory Name="Memory">
      <Counters>
        <Counter Name="% Committed Bytes In Use" />
        <Counter Name="Available Mbytes" />
      </Counters>
    </CounterCategory>
    <CounterCategory Name="Processor">
      <Counters>
        <Counter Name="% Processor Time">
          <ThresholdRules>
            <ThresholdRule
              Classname="Microsoft.VisualStudio.TestTools.WebStress.Rules.ThresholdRuleCompareConstant,
              Microsoft.VisualStudio.QualityTools.LoadTest">
              <RuleParameters>
                <RuleParameter Name="AlertIfOver" Value="True" />
                <RuleParameter Name="WarningThreshold" Value="80" />
                <RuleParameter Name="CriticalThreshold" Value="95" />
              </RuleParameters>
            </ThresholdRule>
          </ThresholdRules>
        </Counter>
      </Counters>
    </CounterCategory>
    <Instances>
      <Instance Name="*" />
    </Instances>
  </CounterCategories>
  <CounterCategory Name="PhysicalDisk">
    <Counters>
      <Counter Name="% Disk Read Time" Range="100" />
      <Counter Name="% Idle Time" Range="100" HigherIsBetter="true">
        <ThresholdRules>
          <ThresholdRule
            Classname="Microsoft.VisualStudio.TestTools.WebStress.Rules.ThresholdRuleCompareConstant,
            Microsoft.VisualStudio.QualityTools.LoadTest">
            <RuleParameters>
              <RuleParameter Name="AlertIfOver" Value="False" />
              <RuleParameter Name="WarningThreshold" Value="40" />
              <RuleParameter Name="CriticalThreshold" Value="20" />
            </RuleParameters>
          </ThresholdRule>
        </ThresholdRules>
      </Counter>
    </Counters>
    <Instances>
      <Instance Name="*" />
    </Instances>
  </CounterCategory>
  <CounterCategories>

```

New To 2010
Range specifies the graph range.

This all needs to be on one line. Make sure you format it properly when putting it in the final file.

New To 2010
HigherIsBetter is used for highlighting better or worse results in the Excel reports.

New To 2010
RangeGroup uses a common range for all counters in that range group.

Performance Counter Considerations on Rigs with slow links

Having a slow WAN between the controller and agents may definitely cause some timeouts or delays in performance counter collection. Each performance counter category is read in a separate operation: that's one method call at the level of the .NET classes that we call, and I don't know if each call results in just one or more than one network read.

There are some timeout settings for performance counter collection that you can change by editing the QTController.exe.config file (*or VSTestHost.exe.config file when running locally on VSTS 2008, or in devenv.config.exe for 2010*) and adding these lines:

```
<appSettings>
  <add key="LoadTestCounterCategoryReadTimeout" value="9000"/>
  <add key="LoadTestCounterCategoryExistsTimeout" value="30000"/>
</appSettings>
```

The values are in ms, so 9000 is 9 seconds. If you make this change, also change the load test sample rate to be larger than this: at least 10 or preferably 15 seconds, and yes with many agents located far from the controller, it is recommended to delete most of the categories in the Agent counter set (perhaps just leave Processor and Memory).

The .NET API that used to read the performance counters is PerformanceCounterCategory.ReadCategory(), so the entire category is read even if the counter set definition only includes one counter and one instance. This is a limitation at the OS level in the way performance counters are read.

The defaults in VSTS are:

- LoadTestCounterCategoryReadTimeout: 2000 ms (2 seconds)
- LoadTestCounterCategoryExistsTimeout: 10000 ms

Increase the performance counter sampling interval for longer tests

Choose an appropriate value for the “Sample Rate” property in the Load Test Run Settings based on the length of your load test. A smaller sample rate, such as the default value of five seconds, requires more space in the load test results database. For longer load tests, increasing the sample rate reduces the amount of data collected.

Here are some guidelines for sample rates:

Load Test Duration	Recommended Sample Rate
< 1 Hour	5 seconds
1 - 8 Hours	15 seconds
8 - 24 Hours	30 seconds
> 24 Hours	60 seconds

Changing the default counters shown in the graphs during testing

If you want to change the default set of counters that show up in the graphs when you start a test, you can go into each of the .counterset XML files (same directory as above) and set or add to the

DefaultCounter entries in the following section (at the bottom of the files):

```
<DefaultCountersForAutomaticGraphs>
  <DefaultCounter CategoryName="Memory" CounterName="Available MBytes"/>
</DefaultCountersForAutomaticGraphs>
```

Possible method for fixing “missing perfmon counters” issues

On the controller machine for your rig, map a drive to each of the machines you will be collecting perf counters for within the load test. Then, before you kick off a test, open each drive you mapped and verify that you have connectivity. Leave the window open during the test.

How and where Performance data gets collected

There are two types of data collected by VSTS during a test run: Real perfmon counters and pseudo perfmon counters. All real perfmon counters are collected directly by the VSTS Controller machine.

In the Load Test editor, all of the performance counter categories that start with “LoadTest:” (see the LoadTest counter set in the load test editor) is data that is collected on the agents by the load test runtime engine. These are not real Perfmon counters in the sense that if you try to look at them with Perfmon you won’t see them, though we make them look like Perfmon counters for consistency in the load test results database and display. The agents send this some of this data (see below) in messages to the controller every 5 seconds which rolls up the agent (e.g. Requests / sec across the entire rig rather than per agent). The controller returns the rolled up results to Visual Studio for display during the run and also stores them in the load test results database.

[Requests Per Second Counters] The VS RPS does not count cached requests, even though VSTS is sending an http GET with if-modified-since headers.

What data is sent every 5 seconds? we do everything possible to limit how much data is sent back in that message. What we do send back is the average, min, max values for all of the pseudo performance counters in the categories that start with “LoadTest:” that you see under the “Overall”, “Scenarios” and “Errors” nodes in the load test analyzer tree (nothing under the “Machines” node). Note that the biggest factor in the size of these result messages is the number of performance counter instances, which for Web tests is mostly determined by the number of unique URLs reported on during the load test. We also send back errors in these 5 seconds messages, but details about the failed requests are not sent until the end of the test, so tests with lots of errors will have bigger messages. Lastly, we only send back metadata such as the category names and counter names once and use numeric identifiers in subsequent messages, so the messages at the start of the load test may be slightly larger than later messages.

One thing you could do to reduce the size of the messages is to reduce the level of reporting on dependent requests. You could do this by setting the “RecordResult” property of the WebTestRequest object to false. This eliminate the page and request level reporting for that request, but you could add a transaction around that request single request and that would really match the page time for that request

Data and Results

Custom Data Binding in UNIT Tests

The first thing to do is create a custom class that does the data initialization (as described in the first part of this post: <http://blogs.msdn.com/slumley/pages/custom-data-binding-in-web-tests.aspx>). Next, instantiate the class inside your unit test as follows:

```
[TestClass]
public class VSTSClass1
{
    private TestContext testContextInstance;

    public TestContext TestContext
    {
        get { return testContextInstance; }
        set { testContextInstance = value; }
    }

    [ClassInitialize]
    public static void ClassSetup(TestContext a)
    {
        string m_ConnectionString = @"Provider=SQLOLEDB.1;Data
Source=dbserver;Integrated Security=SSPI;Initial Catalog=Northwind";
        CustomDs.Instance.Initialize(m_ConnectionString);
    }
    [TestMethod]
    public void Test1()
    {
        Dictionary<string, string> dictionary = customDs.Instance.GetNextRow();
        //.....Add the rest of your code here.
    }
}
```

Verifying saved results when a test hangs in the “In Progress” state after the test has finished

If you run a test and either the test duration or the number of iterations needed for completion of the test have been reached, but the test stays in the “In Progress” state for a long time, you can check if all of the results have been written to the load test results repository by running this SQL query against the LoadTest database:

```
select LoadTestName, LoadTestRunId, StartTime, EndTime from
LoadTestRun where LoadTestRunId=(select max(LoadTestRunId) from
LoadTestRun);
```

If the EndTime has a non-NULL value then the controller is done writing results to the load test results database and it should be safe to restart the rig (killing anything if needed).

This doesn't necessarily mean that all results from all agents (if the agents got hung) were successfully written to the load test database, but it does mean that there's no point in waiting before killing the agents/tests.

The metrics during and after a test differ from the results seen.

Scenario 1:

When you run load tests and look at the numbers you get while the tests are running, the values you see may not be the same values that you get when you load the completed test results at a later point. This behavior is not unexpected, based on warmup and cooldown settings.

Test Run Information

Load test name	iterations
Description	TOR 03 - Iterations - 0w, 5min, 3c
Start time	2/11/2010 1:57:56 PM
End time	2/11/2010 2:02:56 PM
Warm-up duration	00:00:00
Duration	00:05:00
Controller	Local run
Number of agents	1
Run settings used	Run Settings1

Overall Results

Max User Load	10
Tests/Sec	0.13
Tests Failed	0
Avg. Test Time (sec)	61.7
Transactions/Sec	0.13
Avg. Transaction Time (sec)	25.6
Pages/Sec	1.75
Avg. Page Time (sec)	1.73
Requests/Sec	47.9
Requests Failed	0
Requests Cached Percentage	42.6
Avg. Response Time (sec)	0.063
Avg. Content Length (bytes)	935

0 warmup

3 min cooldown

Key Statistic: Top 5 Slowest Tests

Name	95% Test Time (sec)
BasicGraphics_NoVariations	64.7

Test Run Information

Load test name	iterations
Description	TOR 04 - Iterations - 3w, 5min, 3c
Start time	2/11/2010 2:11:33 PM
End time	2/11/2010 2:16:33 PM
Warm-up duration	00:03:00
Duration	00:05:00
Controller	Local run
Number of agents	1
Run settings used	Run Settings1

Overall Results

Max User Load	10
Tests/Sec	0.16
Tests Failed	0
Avg. Test Time (sec)	61.1
Transactions/Sec	0.19
Avg. Transaction Time (sec)	25.8
Pages/Sec	1.77
Avg. Page Time (sec)	1.65
Requests/Sec	46.5
Requests Failed	0
Requests Cached Percentage	55.2
Avg. Response Time (sec)	0.063
Avg. Content Length (bytes)	539

Shows That the runs were all very similar So results can be used for comparisons.

3 min warmup

3 min cooldown

Key Statistic: Top 5 Slowest Tests

Name	95% Test Time (sec)
BasicGraphics_NoVariations	61.2

Test Results

Name	Scenario	Total Tests	Failed Tests (% of total)	Avg. Test Time (sec)
BasicGraphics_NoVariations	IterationCompar	40	0 (0)	61.7

Test Results

Name	Scenario	Total Tests	Failed Tests (% of total)	Avg. Test Time (sec)
BasicGraphics_NoVariations	IterationCompar	49	0 (0)	61.1

Comparison of a test with and without warmup. Notice the total number of tests run is different, but the recorded times are close enough to be valid for reporting.

Scenario 2:

When you compare the summary page results to the detailed results values, there can be a difference in what is reported. This is due to the implementation of collecting the timing details, which are currently flushed when a test iteration ends. For iterations that are in progress with in-flight requests, we give the iteration 10 seconds (configurable via cooldown) to complete any in-flight requests. If they do not complete, the transactions in those iterations are not counted in the details, but are counted in the summary page.

How new users and return users affect caching numbers

Comparing VSTS Results to IIS Results for 100% new vs. 100% return

This section shows how VSTS handles caching and how to interpret the numbers shown for total requests and cached requests.

TOR 09 - Caching - ReturnUsers

From IIS Logs

HTM 268
HTML 263
GIF 83
BMP 32719
200 OK - 3871
304 Not Modified - 29462

VSTS Requests: 33,333
VSTS Requests Cached: 84,507

TOR 10 - Caching - NewUsers

From IIS Logs

HTM 276
HTML 271
GIF 276
BMP 90243
200 OK - 46639
304 Not Modified - 44427

VSTS Requests: 89,384
VSTS Requests Cached: 43,758

Comparing New Users to Return Users (WRT caching):

New users are simulated by “clearing” the cache at the start of each new iteration, whereas the cache is carried from iteration to iteration for return users.

This results in many more requests being cached with return users.

NOTE: The total # of requests made by VSTS is a sum of the two VSTS values. In other words, “Total Requests” in the IDE does not include cached requests.

Comparing the same tests using HTML's Content Expiration setting

TOR 12 - Caching - ReturnUsers - Content Expiration

From IIS Logs

HTM 270
HTML 264
GIF 85
BMP 3330
200 OK - 3874
304 Not Modified - 75

VSTS Requests: 3,949
VSTS Requests Cached: 84,842

Looking at the impact of “content expiration” on the overall network and web server activity (For more information, see the section “Add an Expires or a Cache-Control Header” from <http://developer.yahoo.com/performance/rules.html>).

Notice that VSTS honors the content expiration (this is actually handled by the underlying System.NET component). However, VSTS still reports the cached file request, even though no call went out the wire. This is expected behavior since the request was a part of the site. In order to see how many requests went on the wire, you need to use IIS logs or network traces.

TOR 11 - Caching - NewUsers - Content Expiration

From IIS Logs

HTM 268
HTML 262
GIF 268
BMP 44622
200 OK - 45286
304 Not Modified - 134

VSTS Requests: 44,742
VSTS Requests Cached: 42,090

Notes:

- All 4 tests above were run for the same duration with the same number of users executing the same test.
- Although the numbers do not match exactly, they are close enough to show the behavior of the tests. The discrepancy is due to a few things, including cool down of the test and the possible mis-alignment of the query I used to gather data from the IIS logs.
- The IIS Log items for “200 –OK” and “304-Not Modified” were gathered using LogParser and the following query:

```
SELECT
    sc-status, COUNT(*) AS Total
FROM *.log
WHERE
    to_timestamp(date, time) between
        timestamp('2010-02-12 02:13:22', 'yyyy-MM-dd hh:mm:ss')
    and
        timestamp('2010-02-12 02:18:22', 'yyyy-MM-dd hh:mm:ss')
GROUP BY
    sc-status
```

data sources for data driven tests get read only once

When initializing data driven tests the data is read ahead of time, and only retrieved once. Therefore there is no need to optimize the connection to the data source.

Consider including Timing Details to collect percentile data

There is a property on the Run Settings in the Load Test Editor named "Timing Details Storage". If Timing Details Storage is enabled, then the time to execute each individual test, transaction, and page during the load test will be stored in the load test results repository. This allows 90th and 95th percentile data to be shown in the load test analyzer in the Tests, Transactions, and Pages tables. VS 2010 adds 99th percentile and standard deviation stats. Also, in VS 2010 this setting is on by default. Consider turning it off for very large load tests, as with a many-agent test it can take up to half the time of the load test to process all the timing details. In other words, if you have a 12 hour load test running on 30 agents it could take 6 hours to collect and crunch all the data. In VS 2010, the details data is also used to populate the virtual user activity chart.

The amount of space required in the load test results repository to store the Timing Details data may be very large, especially for longer running load tests. Also, the time to store this data in the load test results repository at the end of the load test is longer because this data is stored on the load test agents until the load test has finished executing at which time the data is stored into the repository. For these reasons, Timing Details is disabled by default. However if sufficient disk space is available in the load test results repository, you may wish to enable Timing Details to get the percentile data. Note that there are two choices for enabling Timing Details in the Run Settings properties named "StatisticsOnly" and "AllIndividualDetails". With either option, all of the individual tests, pages, and transactions are timed, and percentile data is calculated from the individual timing data. The difference is that with the StatisticsOnly option, once the percentile data has been calculated, the individual timing data is deleted from the repository. This reduces the amount of space required in the repository when using Timing Details. However, advanced users may want to process the timing detail data in other way using SQL tools, in which case the AllIndividualDetails option should be used so that the timing detail data is available for that processing.

Consider enabling SQL Tracing through the Load Test instead of separately

There is a set of properties on the Run Settings in the Load Test Editor that allow the SQL tracing feature of Microsoft SQL Server to be enabled for the duration of the load test. If enabled, this allows SQL trace data to be displayed in the load test analyzer on the "SQL Trace" table available in the Tables dropdown. This is a fairly easy-to-use alternative to starting a separate SQL Profiler session while the load test is running to diagnose SQL performance problems. To enable this feature, the user running the load test (or the controller user in the case of a load test run on a rig) must have the SQL privileges needed to perform SQL tracing, and a directory (usually a share) where the trace file will be written must be specified. At the completion of the load test, the trace file data is imported into the load test repository and associated with the load test that was run so that it can be viewed at any later time using the load test analyzer.

How to collect SQL counters from a non-default SQL instance

If you want to collect performance counters from a SQL Server instance while running a load test, you can do this easily by checking the SQL counter set in the "Manager Counter Sets" dialog in the VSTS load test editor. Doing this includes the default counter set for SQL Server in your load test. The performance counter category names that are specified in this counter set begin with "SQLServer:"; for example "SQLServer:Locks".

However, if you are trying to monitor **another SQL Server instance** that is not the default SQL server instance, the names of the performance counter categories for that instance will have different category names. For example, if your SQL server instance is named "INST_A", then this performance counter category will be named "MSSQL\$INST_A:Locks". To change the load test to collect these performance counters, the easiest thing to do is open the .loadtest file with the XML editor or a text editor and replace all instances of "SQLServer:" by "MSSQL\$INST_A:Locks" (correcting the replacement string for your instance name).

How 90% and 95% response times are calculated

Within the load test results summary page, the percentile values mean that:

- 90% of the total transactions were completed in **less than <time>** seconds
- 95% of the total transactions were completed in **less than <time>** seconds

The calculation of the percentile data for transactions is based not on the sampled data that is shown in the graph, but on the individual timing details data that is stored in the table LoadTestTransactionDetail. The calculation is done using a SQL stored procedure that orders the data by the slowest transaction times, uses the SQL "top 10 percent" clause to find the 10% of the slowest transactions then uses the min() function on that set of rows to get the value for the 90th percentile time. The stored procedure in the LoadTest database that does this is "Prc_UpdateTransactionPercentiles".

Transaction Avg. Response Time vs. Request Avg. Response Time

For each HTTP request (including each dependent request) there is a request response time, and these are all averaged to get the “Avg. Response Time” that appears on the default graph and on the Requests table in the load test analyzer. There is also the “Avg. Page Time” (seen on the Pages table and can be graphed, but is not be default) that is the average time to download the request that is in the web test plus the time to download all dependents (dependents may be downloaded in parallel). Then for transactions, there are two counters: “Avg. Response Time” and “Avg. Transaction Time”. The former is the average of the sum of all of the page times (without the think times), and the latter is the same but includes the think times.

For more descriptions see this online doc page: <http://msdn.microsoft.com/en-us/library/ms404656.aspx>.

Considerations for the location of the Load Test Results Store

When the Visual Studio Team Test Controller is installed, the Load Test Results Store is set up to use an instance of SQL Express that is installed on the controller computer. SQL Express is limited to using a maximum of 4 GB of disk space. If you are going to run many load tests and want to keep the results for a while, you should consider configuring the Load Test Results Store to use an instance of the full SQL Server product if available. See the Visual Studio Team Test documentation for instructions on setting up the database to be used as the Load Test Results Store.

Set the recovery model for the database to simple

VSTS 2008 – By default the recovery model in SQL server for the Load Test Results Store is set to “full”. You should change this to simple.

VSTS 2010 – There was a change in the way the recovery model was configured in the loadtestresultsrepository.sql command that ships with VSTS 2010, but the change does not take effect due to a different command further down in the script. This issue is known and will be resolved in a future version.

To change either version - Open SQL Management Studio and connect to the server that has the LoadTest/LoadTest2010 database. Right click on the LoadTest/LoadTest2010 database in “Object Explorer” and choose “Properties”. Go to the “Options” page and change the drop down for “Recovery Model” to Simple.

How to clean up results data from runs that did not complete

If you have a Load Test Run that abnormally aborts and does not show data in a consistent manner (or does not show up in the list of runs as either completed or aborted), you can use the following query on the SQL repository server to clean up the database:

```
update LoadTestRun set Outcome='Aborted' where Outcome='InProgress'
```

The Outcome field is left blank until the test either completes or is manually aborted. Any test results in the DB cannot be accessed through the GUI until the Outcome field has one of the two values 'Completed' or 'Aborted'

InstanceName field in results database are appended with (002), (003), etc.

Question: In the LoadTest databases, the Instance Names are sometimes appended with "(002)", etc. For example, I have a transaction called "Filter Render Request" and in the load test database I have two transactions. Also, I have a URL pointing to RenderWebPartContent and I have several entries. Can someone give me a quick explanation?

Answer: To make a long story short it is a unique identifier that is used mostly internally to distinguish between cases where you have the same test name in two different scenarios in the load test or the same page name (simple file name) in different folders in two different requests.

Layout for VSTS Load Test Results Store

Changed in 2010

For VSTS 2008:

<http://blogs.msdn.com/billbar/articles/529874.aspx>

For VSTS 2010:

<http://blogs.msdn.com/slumley/archive/2010/02/12/description-of-tables-and-columns-in-vs-2010-load-test-database.aspx>

How to view Test Results from the GUI

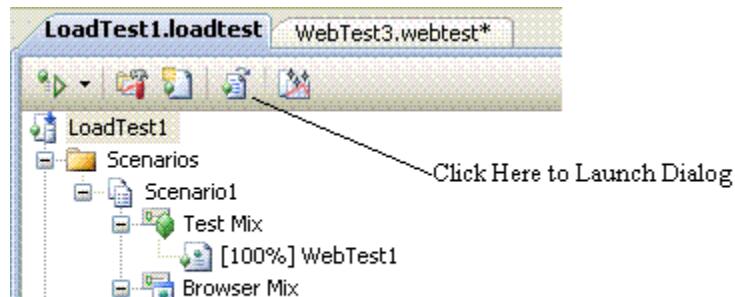
<http://blogs.msdn.com/slumley/pages/managing-load-test-results.aspx>

SQL Server Reporting Services Reports available for download

<http://blogs.msdn.com/slumley/pages/load-test-reports.aspx>

How to move results data to another system

VSTS 2008 introduces a GUI results manager. The manager works on the Load Test Results Store that is currently specified in the “Administer Test Controller” dialog box, or on the local repository. To open the results manager, you must have a load test opened and set as the active window. Then click on the icon shown below:



How to launch the “Manage Load Test Results” dialog box

Once in the manager, you choose a controller name from the drop down list (or <local> if you want the results from the local database) and the manager will populate with the tests it finds. You can select whatever test results you wish to move, and then choose “export” to move them into a file (compressed with an extension of .ltrar). That file can be moved to another machine and then imported into a new results store.

Load Test Results without SQL NOT stored

It is possible to configure a load test to run without a SQL load test repository. This is configured by changing the Storage Type property on the Run Settings node in the load test editor. There are 2 options for this property: Database and None. I strongly recommend that you always use database. If you run a load test with the storage property set to none, the results are only kept in memory. So as soon as you close the Load Test Execution UI, the results are gone.

You might wonder why there is still an entry in the Test Results window and what effect importing/exporting the test result would have.

Test Results				
slumley@SLUMLEYLT 2010-02-12 09: [Run] [Debug] [Group By: [None]] [All Columns] <Type keyword>				
Test run completed Results: 1/1 passed; Item(s) checked: 0 Export Test Run Results				
	Result	Test Name	Project	Error Message
<input type="checkbox"/>	<input checked="" type="checkbox"/> Completed	LoadTest1	TestProject2	

For most result types all of the data needed to display the result can be exported into a TRX file. This is not true for load tests. The only thing that a TRX file stores for a load test is the connection string to the database with the results and the run id of the run to load. So if you do not run the load test with storage type set to database, then exporting the TRX file is useless. It will contain no useable data that you can use for later analysis. So ALWAYS use a database when running load tests.

Unable to EXPORT from Load Test Repository

If you create a custom LoadTest results repository (using a name other than "LoadTest"), the import/export functionality in VSTT 2008 will not work. This is a known issue and is fixed in VS2010.

The error will look like:

```
[V, 3160, 6, 2009/11/30 16:06:15.808] devenv.exe: StateMachine(AgentState): calling state handler for Online
[V, 3160, 7, 2009/11/30 16:06:15.813] devenv.exe: ControllerObject: RunQueueThread waiting for runs...
[I, 3160, 4, 2009/11/30 16:06:15.889] devenv.exe: WebLoadTestAdapter: Opened connection to results repository
[I, 3160, 4, 2009/11/30 16:06:16.426] devenv.exe: WebLoadTestAdapter: Closed connection to results repository
[V, 3160, 4, 2009/11/30 16:06:36.201] devenv.exe: WebLoadTestAdapter:
LoadTestExporterImporter running: bcp "select * from LoadTest.dbo.LoadTestRun where LoadTestRunId in (278)" queryout
"C:\Users\sellak\AppData\Local\Temp\3\LoadTestResults.7408358f-3580-4a38-9781-409d90c52a22\LoadTestRun.dat" -S AXPERFORMANCE -T -N
[V, 3160, 4, 2009/11/30 16:06:36.367] devenv.exe: WebLoadTestAdapter: bcp output: SQLState = 42S02, NativeError = 208
Error = [Microsoft][SQL Native Client][SQL Server]Invalid object name 'LoadTest.dbo.LoadTestRun'.
```

Notice the call to LoadTest.dbo.LoadTestRun is hardcoded, which is what causes the feature to break.

In general, we recommend you use the LoadTest database name (or in the case of 2010, the database is named LoadTest2010).

Web Test TRX file and the NAN (Not a Number) Page Time entry

In VSTS 2008, if a Web Test trx file is opened in an XML editor, you may notice the NAN page time for some of the responses.

```
<Response url="http://teamtestweb1/storecsvs/"  
    contentType="text/html; charset=utf-8"  
    statusLine="HTTP/1.1 200 OK"  
    pageTime="NaN"  
    time="0.006"  
    statusCodeString="200 OK"  
    contentLength="12609">
```

When/why does this happen?

This only happens to non top-level requests, i.e. redirects and dependents.

At the end of Web test execution, all results (objects and their members) are serialized to a trx file, including the pageTime. NAN is the result of doing a `.ToString()` on a float or double value that has not been initialized. This means that the pageTime is not known at the time this entry was written to the trx.

The following is the screenshot of the Web test result file opened in the Playback window. It shows how this property is set in the code.

Request	HTTP Status	Total Time	Request Time
✓ http://teamtestweb1/testwebsite	301 Moved Permanently	0.039 sec	0.032 sec
✓ http://teamtestweb1/testwebsite/	200 OK	-	0.007 sec
✓ http://teamtestweb1/favicon.ico	200 OK	0.026 sec	0.026 sec
✓ http://teamtestweb1/storecsvs	301 Moved Permanently	0.124 sec	0.003 sec
✓ http://teamtestweb1/storecsvs/	200 OK	-	0.006 sec
✓ http://teamtestweb1/storecsvs/IBuySpy.css	200 OK	-	0.031 sec
✓ http://teamtestweb1/storecsvs/images/sitebkgrdnogray.gif	200 OK	-	0.046 sec
✓ http://teamtestweb1/storecsvs/images/grid_background.gif	200 OK	-	0.028 sec

The high-lighted one is the top-level page. It is redirected and the redirected to page has some dependent requests. The 'Total Time' for the top-level page, i.e. the page time, refers to the time to send all requests and receive all responses (including the redirects and dependents) from the Web server. It is only calculated and populated for the primary request, but not for 'redirected to' and the dependents. This is why that you are seeing Nan page time in the XML file.

Proper understanding of TRX files and Test Results directory

Changed in 2010

TRX files are the result files created when you run a unit or web test in Visual Studio. There are two pieces here. The first describes how TRX files are constructed in VSTS 2008, and the second part shows how things have changed for VS 2010

In 2008

In VS 2008, if you run a Web test outside a load test, the entire Web test result is serialized to the trx file. So each request and response in the test is serialized. If the test runs multiple iterations, the trx file can get very large.

We added optimizations to control the amount data that is stored in the TRX for request/response bodies by only storing one copy of a unique response bodies (in multi-iteration runs you may end up with multiple identical responses). Also, the request and response bodies are compressed to dramatically reduce the amount of space they require in the TRX.

There is a test context snapshot stored before every request (including dependent requests). Sometimes, you'll find really large VIEWSTATE in a test context that can make them really large.

The request/response headers and the test context snapshots are not compressed and duplicates are not eliminated, so they have the potential to become bloated.

In 2010

In VSTS2010, there is one major change on how the WebTestResultDetails class is persisted upon test completion. Instead of writing the WebTestResultDetails class to a trx file, VSTS serializes the object to a *.webtestResult file. The relative path of this file is added as an element to the trx file. By saying 'relative', it means relative to the path of the corresponding trx file.

```
<Results>
  <WebTestResult executionId="6516bca4-4648-44e3-b50a-568ae6add0e0" testId="f4289b0c-6303-4e3c-bd27-23b8ab424292" testName="WebTest2" computerName="MSL-...
    <ResultFiles>...</ResultFiles>
    <TestSettings name="Local" id="d3f037b0-b9d8-4">...</TestSettings>
    <WebTestResultFilePath>vseqa1_MSL-2791387 2010-02-16 13_47_07\In\6516bca4-4648-44e3-b50a-568ae6add0e0\WebTest2.webtestResult</WebTestResultFilePath>
  </WebTestResult>
</Results>
```

- The file only exists on the machine that you run the Web test from, i.e. the VSTS / mstest machine.
- For a local run, the file goes to \TestResults\prefix_Timestamp\In\TestExecuId.
- For a remote run, the file goes to \TestResults\prefix_Timestamp\In\Agent\TestExecuId.
- When you open a Web test trx file from the Test Results window, VSTS reads the value of **WebTestResultFilePath** from the trx file, and then loads the **.webtestResult** from TrxDirecory\WebTestResultFilePath into Web Test Result window.

Note about Data Collectors and TRX files

If you have data collector(s) turned on for a unit/Web test, the collector data, e.g. event log, go to \TestResults\prefix_Timestamp\In\TestExecuId\Agent. For a Load test, collector data go to \TestResults\prefix_Timestamp\In\Agent.

Understanding the Response Size reported in web test runs

If you look at the size of a response shown for a single pass of a web test (within the test results window), it may differ from the size reported from tools such as Fiddler or Netmon. This is due to the fact that VSTS is measuring the size of the response after it has been uncompressed, while Fiddler and Netmon will look at the size of the response on the wire.

This behavior has been changed in SP1, HOWEVER, there are a couple of gotchas to be aware of:

- The compressed size will only be reported in VSTS if the response is NOT using “chunked encoding”
- The test results window will not indicate whether the reported size is the compressed or the uncompressed size.
- VSTS has a receive buffer that defaults to 1,500,000 bytes and it throws away anything over that. The number reported is what is saved in the buffer, not the number of bytes received. You can increase the size of this buffer by altering the ResponseBodyCaptureLimit at the start of your test. This needs to be done in code and cannot be modified in a declarative test.

Errors and Known Issues

CSV files created in VSTS or saved as Unicode will not work as data sources

If you create a CSV file in VSTS, it saves the file with a 2 byte prefix indicating encoding type, which is hidden. When you select the file as a data source, the first column will be prefixed with two unusual characters. The problem is the two bytes on the front that cannot be seen unless the file is viewed in hex format. The solution is to open the file in notepad and save as ANSI.

Also, if a data file is created in Windows® Notepad or Microsoft® Excel® and saved as Unicode, it looks good in Notepad or VSTS, but cannot be read in web tests. The solution is to open the file in notepad and save as ANSI.

Incorrect SQL field type can cause errors in web tests

If you create a SQL table to hold test parameters and you use the default SQL column type **nchar(50)**, you will get failed requests and the context parameters in the “request” tab of the test results will not show the bad parameters. The **nchar** field pads all entries to the specified length with hidden characters but the “request” view in the test results does not show them. In order to see the extra characters, click on the “View Raw Data” checkbox and look through the data until you see the hidden characters. This will indicate that the wrong SQL field type is being used.

Leading zeroes dropped from datasource values bound to a CSV file

If you have a datasource which contains values that start with the number 0, and you have this datasource in a CSV file, VSTT will strip the leading zero(es) from the values when using them. The same behavior does NOT occur to data values in a SQL datasource.

Recorded Think Times and paused web test recordings

Changed in 2010

When you are recording a web test, VSTS uses the time between steps as you record to generate the ThinkTime values after each request. When you add a comment, the recorder switches from RECORD mode to PAUSE mode, however, the timer to calculate think times does not pause, so you end up with think times that include the time you spent typing in the comment. This is also true if you manually pause the recording for any other reason. To fix this, do the following:

In 2008

Go through the test after recording is complete and adjust the think times manually.

In 2010

VS 2010 offers a new dialog to make this easy. See the section [New “Reporting Name” property for web requests](#)

After opening a webtest with the VS XML Editor, it will not open in declarative mode.

Applies only to 2010

In the VS IDE, you can right click on a webtest file and choose to “Open in XML Editor”. Once you do that and then close the window, the next time you double click on the webtest to open it, the file should open in the default declarative view. However, in VSTS 2010 there is a known issue that causes the webtest to always be opened in XML mode.

To work around this issue:

- 1) open the test project file (e.g. .csproj),
- 2) look for the web test that is opened as XML,
- 3) delete the line ‘<SubType>Designer</SubType>’
- 4) save the test project.

Example of the section needing to be changed:

```
-----  
<None Include="WebTest1.webtest">  
    <CopyToOutputDirectory>Always</CopyToOutputDirectory>  
    <SubType>Designer</SubType>  
</None>  
-----
```

Calls to [HTTPS://Urs.Microsoft.Com](https://Urs.Microsoft.Com) show up in your script

If you record a script using IE7 and you have phishing enabled, you can get extra calls to Urs.Microsoft.Com. These calls are being made by IE as part of the phishing filter in IE (for more information, please go to: http://download.microsoft.com/download/2/8/e/28e60dcc-123c-4b27-b397-1f6b2b6cb420/Part1_MM.pdf). You may either remove these calls, or disable phishing in IE before you make the calls. To disable phishing, go to TOOLS -> PHISHING FILTER -> TURN OFF AUTOMATIC WEBSITE CHECKING.

Possible DESKTOP HEAP errors when driving command line unit tests

When you run a large number of unit tests that call command line apps, and they are run on a test rig (this does not happen when running tests locally), you could have several of the tests fail due to running out of desktop heap. You need to increase the amount of heap that is allocated to a service and decrease the amount allocated to the interactive user. See the following post for in depth information, and consider changing the registry as listed below:

<http://blogs.msdn.com/ntdebugging/archive/2007/01/04/desktop-heap-overview.aspx>

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager\SubSystems  
OLD SETTING: "Windows SharedSection=1024,3072,512"  
NEW SETTING: "Windows SharedSection=1024,1024,2460"
```

Goal based load tests in VSTS 2008 do not work after applying SP1

Changed in 2010

There is a QFE available that fixes the following bugs with Goal Based Load Patterns that were introduced in VSTS 2008 SP1:

- If you defined a goal based load pattern using a performance counter from any of the “LoadTest:” categories, an error would occur and the user load would not be adjusted according to the goal.
- If you defined a goal based load pattern using a “single instance” performance counter (for example Memory\Available Mbytes), an error would occur and the user load not be adjusted according to the goal.
- If the Machine Name property entered for the goal based performance counter did not exactly match the casing for the computer name, an error would occur and the user load would not be adjusted according to the goal.

The hotfix can be obtained from:

<http://support.microsoft.com/kb/957451>

This is no longer an issue in VS 2010

Using Named Transactions in a Goal-Based Load Profile can cause errors

When keeping track of transactions in a test, VSTS postpends the transaction name with a number in parentheses. This is to differentiate transactions that use the same name in different tests and keep the collected metrics separate. Because of this, using a specific transaction name in a goal based load profile will most likely give you the error: *“A LoadTestPlugin attempted to set the 'MinTargetValue' property of the load profile for Scenario Scenario1 of Load Test LoadTest1; this is not allowed after the LoadTestLoadProfile has been assigned to the LoadProfile property of the LoadTestScenario.”* This is due to the naming convention used by VSTS described above. There is no way to use wildcards in the fields so you would have to know the exact postpended value.

Also, Even if you know the value, you may see the error near the beginning, since the transaction may not have run yet, so the instance to check may not yet exist.

Debugging Errors in Load Tests

<http://blogs.msdn.com/slumley/pages/debugging-errors-in-load-test.aspx>

Debugging OutOfMemory Exceptions in Load Tests

<http://blogs.msdn.com/billbar/pages/diagnosing-outofmemoryexceptions-that-occur-when-running-load-tests.aspx>

Memory leak on load test when using HTTPS

Problem: There is a memory leak in VS 2008 when running load tests that contain both HTTP and HTTPS requests.

Resolution: We've analyzed this memory leak and determined that this is a bug in the System.Net.HttpWebRequest class (used to issue Web test requests) that occurs when the Web test target https Web sites. A workaround is to set the Load Test to use the "Connection Pool" connection model. This problem is fixed in VS 2010.

"Not Trusted" error when starting a load test

When you start a load test, you may get the following error:

"The location of the file or directory xxx is not trusted"

This can occur if you have signed code in your test harness and you make changes to some of the code without resigning it. You can try either one of the below options to attempt to resolve it:

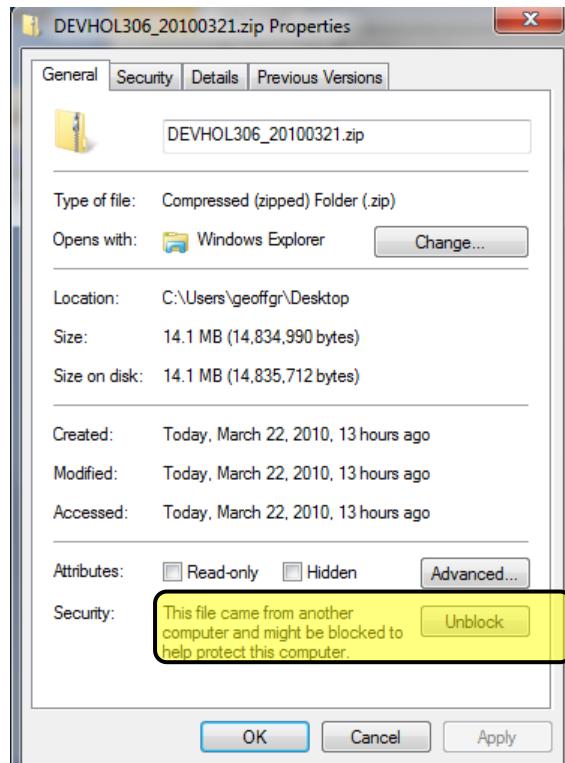
OPTION 1:

1. In the .NET Framework 2.0 Configuration, Go to Runtime Security Policy | Machine | All_Code
2. Right click All_Code, select "New...", and select any name for your new group. Click Next
3. Select URL as your condition
4. Type \\machine_name\shared_folder\assembly.dll or \\machine_name\shared_folder* and click Next
5. Make sure permission is set to FullTrust
6. Click Next, and Finish
7. Close all your Visual Studio IDEs, restart, and try again

OPTION 2:

```
caspol -machine -addgroup 1 -url file:<location XXX>/* FullTrust -name FileW
```

This issue can also occur if you have a downloaded zip file (or other) that is flagged in the properties as "Blocked". You need to unblock it to use. Right click on the file and go to the properties:



Detail Logging may cause “Out of disk space” error

New to 2010

When you use the new feature in VS 2010 “Save Log on Test Failure”, you may get an “Out of disk space” error. Depending on the number of “Maximum Test Logs” and the size of data for each iteration, the logs being saved can be very large(for instance, a webtest that uploads and/or downloads large files).

Error details and stack traces no longer available in VSTS 2010

New to 2010

When a particular request encountered an error in VSTS 2008 while running a load test (with “Timing Details Storage” set to “All Individual Details”), you could go to the details of the error and see the information specific to that request. This option is no longer in VS 2010. It has been replaced by the new detailed logging feature that logs the entire Web test or unit test result for a failed virtual user iteration.

VSTS does not appear to be using more than one processor

If you are running a load test on a multi processor machine but notice that only one processor is being used, this is due to the fact that you are running the test as “<Local – no controller>”. VSTS will only use multiple processors on an Agent/Controller setup. This is by design due to licensing considerations. In order to take advantage of multi-proc systems, please use an agent and controller setup. It is possible to setup the controller and agent on the same machine as VSTS.

While the limitation in the product still exists in 2010, however, you can unlock all processors by installing a vUser license on the local machine. See “New Load Test and Load Test Rig Licensing and configurations” for more information.

Changes made to Web Test Plugins may not show up properly

If you have a plugin that is part of the same project as a declarative web test, and you make changes in the plugin, you may not always see those changes reflected in the test run. For instance, if you have a plugin that writes a certain string out to an event log, and you change the string in the plugin, you still see the old string value in the event log. This is a known issue and may be fixed in VSTT 2008 SP1 (it is not in the beta release of SP1). In order for the bug to appear, the following conditions must be met:

- You must be running on a controller/Agent test rig
- Your web test must be declarative (bug does not occur with coded web tests)
- You must have a “Test Results” folder in the root of your solution folder

If you are experiencing the bug, you can work around it by:

- Generating a coded web test
- Renaming or deleting the “Test Results” folder
- Changing the test project’s location for the “Test Results” folder

Socket errors or “Service Unavailable” errors when running a load test

When running a load test, you might receive several errors similar to:

- Exception SocketException Only one usage of each socket address (protocol/network address/port) is normally permitted
- HttpError 503 - ServiceUnavailable 503 - ServiceUnavailable

These are often due to exhaustion of available connection ports either on the VSTS machine(s) or on the machines under test. To see if this could be happening, open a CMD window on your VSTS machine(s) and on the machine(s) under test, and run the following command:

“netstat -anp tcp”

If you see this, then you are suffering from port exhaustion. The following explains what is happening and talks about some ways to deal with it.

TCP establishes connections based on the following items:

- Client port + Client IP = Client Socket
- Server Port + Server IP = Server Socket
- Client Socket + Server Socket = connection

The TIME_WAIT state is a throwback from the old days (well more accurately the default of 4 minutes is the throwback). The idea is that if the client closes a connection, the server puts the socket into a TIME_WAIT state. That way, if the client decides to reconnect, the TCP negotiation does not need to occur again and can save a little bit of time and overhead. The concept was created because creating a TCP connection was a costly operation years ago when networks were very slow).

To get around this issue, you need to make more connections available and/or decrease the amount of time that a connection is kept in TIME_WAIT. In the machine’s registry, open the following key and either add or modify the values for the two keys shown:

```
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters]
    "TcpTimedWaitDelay"=dword:0000001e      (30 seconds)
    "MaxUserPort"=dword:0000ffff            (65,535 ports)
```

If you are experiencing the issue on one of the VSTT load machines, you may also need to change the load test connection model to “Connection Pooling” and increase the pool size considerably.

Error “Failed to load results from the load test results store”

“Unable to cast object of type ‘System.DBNull’ to type ‘System.Byte[]’” error when trying to retrieve load test results from the DB inside VSTS.

This error will occur if you get a NULL value in the LoadTest column of the LoadTestRun table. To fix it, go to the table and delete the row that has the NULL value. The occurrence of this issue should be extremely rare.

Hidden Field extraction rules do not handle some fields

Some responses may contain hidden fields whose formats have an extra character that causes the build in “Extract Hidden Fields” rule to not find the value. Consider the following entry in a response:

```
<input type="hidden" name="_ListSchemaVersion_{9fcdfcc2-6d4f-4a22-a379-8224954c1d9a}" id="_ListSchemaVersion_{9fcdfcc2-6d4f-4a22-a379-8224954c1d9a}" value="1" />
```

A default Hidden extraction rule was added to the request. When the rule fired, the result was:

\$HIDDEN2._ListSchemaVersion_{9fcdfcc2-6d4f-4a22-a379-8224954c1d9a}
It should have been

\$HIDDEN2._ListSchemaVersion_{9fcdfcc2-6d4f-4a22-a379-8224954c1d9a}

This is not a bug, but just a side effect of how VS process context parameters.

Test results iteration count may be higher than the max test iterations set

When a test run that defines a specific number of test iterations is complete, you may see more tests run than the iterations set in the run properties. This is rare and is caused by the load test process crashes and restarts. This issue exists in VSTS 2008 and VS 2010. The reason for this is that the Restart file we use to handle restarting a load test after QTAgent dies was never updated to include info about the tests completed, so it will always run the initial number of test iterations after restart.

Resolution:

Find out what is causing QTAgent to crash and fix that issue.

In flight test iterations may not get reported

When a load test is stops, there will be “in-flight” tests and requests. The load test engine gives all in-flight requests 10 seconds to stop. If the request doesn’t finish after some time, we kill the request and don’t record that request detail or test detail.

A way to control this is to specify a Cool-Down period of 10 minutes in the Load Test’s run settings. Assuming that the requests in your Web test have the default request timeout of 5 minutes, all in-flight requests at the time load test completion at one hour should either finish or be timed out in 5 minutes and then the in-flight tests should be displayed in the User Details Test chart.

Completion of Unit Test causes spawned CMD processes to terminate

If you spawn a process from within a web test, and then that process spawns a separate CMD window (using the “START” command), the second CMD window should be totally independent of the test. If this method is used for Unit tests or for Windows applications, it will work as expected. However, web tests will kill the spawned process. Here is an excerpt from an email thread with the product team:

Here’s what I’ve discovered. There is an option in VSTT that allows you to keep VSTestHost alive after a test run completes: go to “Tools”, “Options”, “Test Tools”, “Test Execution” and see the check box “Keep test execution engine running between test runs”. This is on by default, and I’m guessing it is on for you. When you run just a unit test in a test run, this option works and VSTestHost does not get killed when the test run completes, so neither does its child processes. However, when you run a Web test, this option seems to be ignored and VSTestHost is killed by a call to Process.Kill() which I believe does kill the child processes of VSTestHost as well (if you uncheck this option, you’ll see that running the unit test has the same behavior). I’m not sure why VSTestHost goes away even when this option is set when a Web test is run – this may have been intentional. Here’s a workaround that seems to work instead:

- *create a unit test that sleeps for 10 seconds (or whatever time is needed)*
- *create an ordered test that includes your coded Web test first then the unit test that sleeps*
- *run the ordered test rather than the coded Web test*

NOTE: an example of this scenario is firing off a batch file that starts a NETCAP.EXE window to gather trace data during the test run. This NETCAP process must run asynchronously so it will not block the web test. It must also complete by itself or the resultant trace file will not get written.

Web tests should not be starting other processes, or performing any blocking operations as they will cause problems with the load test engine. For the netcap example, a better solution is to write this as a VS2010 data collector.

Bug with LoadProfile.Copy() method when used in custom goal based load tests

If you create a custom goal based load test plugin and use the LoadProfile method Copy(), you will get an error saying: *"A LoadTestPlugin attempted to set the 'MinTargetValue' property of the load profile for Scenario Scenario1 of Load Test LoadTest1; this not allowed after the LoadTestLoadProfile has been assigned to the LoadProfile property of the LoadTestScenario."* This is due to a regression in hotfix 957451. There is currently no fix for this, however there is a workaround. You need to create your own copy method and use it to populate the custom LoadProfile. Make sure that you do NOT set the "ScenarioName" value since this is where the bug lies. Here is some sample code:

The Copy() Method usage that will fail:

```
LoadTestGoalBasedLoadProfile newGoalProfile = _scenario.LoadProfile.Copy() as LoadTestGoalBasedLoadProfile;
```

The custom method to replace the Copy() method:

```
private LoadTestGoalBasedLoadProfile ProfileCopy(LoadTestGoalBasedLoadProfile _profile)
{
    LoadTestGoalBasedLoadProfile _goalLoadProfile = new LoadTestGoalBasedLoadProfile();
    _goalLoadProfile.CategoryName = _profile.CategoryName;
    _goalLoadProfile.CounterName = _profile.CounterName;
    _goalLoadProfile.InstanceName = _profile.InstanceName;
    _goalLoadProfile.InitialUserCount = _profile.InitialUserCount;
    _goalLoadProfile.MinUserCount = _profile.MinUserCount;
    _goalLoadProfile.MaxUserCount = _profile.MaxUserCount;
    _goalLoadProfile.MaxUserCountIncrease = _profile.MaxUserCountIncrease;
    _goalLoadProfile.MaxUserCountDecrease = _profile.MaxUserCountDecrease;
    _goalLoadProfile.MinTargetValue = _profile.MinTargetValue;
    _goalLoadProfile.MaxTargetValue = _profile.MaxTargetValue;

    return _goalLoadProfile;
}
```

Using the method in your HeartBeat event handler:

```
void _loadTest_Heartbeat(object sender, HeartbeatEventArgs e)
{
    // Make a private instance of the profile to edit
    LoadTestGoalBasedLoadProfile _goalLoadProfile =
    ProfileCopy((LoadTestGoalBasedLoadProfile)_scenario.LoadProfile);

    // Do your modifications to the private copy of the profile here
    // [some code]

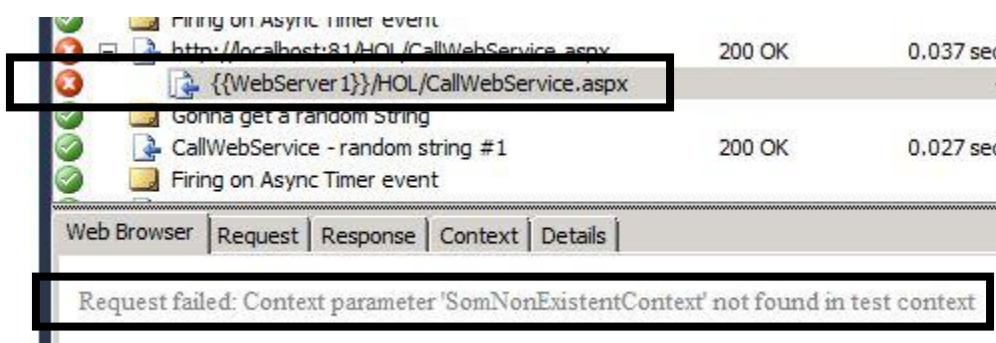
    // Assign your private profile back to the test profile
    _scenario.LoadProfile = _goalLoadProfile;
}
```

Errors in dependent requests in a Load Test do not show up in the details test log

The new Detailed Test Logging feature will not allow you to see the details of errors that occur inside dependent requests during a load test (like AJAX or JSON requests)

The problem is that if a dependent request has an error, even though the test will be flagged as failed, and the log for that iteration will be stored, the log does not contain any details for any dependent requests. Therefore you do not get any details about why the failure occurred.

To work around this issue, you need to make sure any dependent requests that are having problems get moved back up to main requests, at least during a test debugging phase.



Web Test execution shows the failure

Test Results			
Name	Scenario	Total Tests	Failed Tests (% of total)
Copy of UpdatePanelTesting	ReportingNameProperty	2	2 (100)

Load Test execution shows that there is a failure

Errors			
Type	Subtype	Count	Last Message
Total		2	
Exception	WebTestExcept..	2	Context parameter 'S

The errors table in the results shows the exception count and allows you to drill into the details. The picture below shows you how to display the full details log for this failed iteration

Load Test Errors		
Text	Stack	Details
Context parameter 'SomNonExistent... Context parameter 'SomNonExistent...	Stack	Test log
		Test log

Failed Internet Explorer 7.0 LAN

Request
Going to the good old home page http://localhost:81/HOL/HOLHome.htm
Now going to the UpdatePanel Page, first http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a
Gonna get a random String http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a
Gonna get a random String http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a
Gonna get a random String http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a
Gonna get a random String http://localhost:81/HOL/CallWebService.a
Firing on Async Timer event http://localhost:81/HOL/CallWebService.a

WCF service load test gets time-outs after 10 requests

If you encounter time-outs when running a load test against a WCF service that uses message-level security, this could be caused by the WCF service running out of security sessions. The maximum number of simultaneous security sessions is a WCF configuration setting with a default value of 10. Any additional requests to the service that would lead to more security sessions will be queued.

If you want the service support more than 10 simultaneous clients, you will need to change it in the WCF configuration setting. Another reason you might run out of security sessions is when the client isn't properly closing those sessions after it is done with the service.

A WCF security session is established by a security handshake between client and service in which asymmetric encryption is used to establish a symmetric encryption key for additional requests in the same session. The initial asymmetric encryption is more computationally expensive than the symmetric encryption that is used for subsequent requests. A client must explicitly close the security session to release server resources or they will only be released by the server after a time-out in the order of minutes.

If the client only needs to call the web service once, the message exchange with the symmetric key is unnecessary and you can save a roundtrip by disabling security sessions. Set the 'establishSecurityContext' to false in the app.config of the client. This can also serve as a workaround for clients that do not properly close the session, but do keep in mind that this will skew your performance results. So only use this workaround while you fix the client.

For more details on secure sessions and the 'establishSecurityContext' property see
<http://msdn.microsoft.com/en-us/library/ms731107.aspx>

Loadtestitemresults.dat size runs into GBs

During a load test the load agents will write to a file called loadtestitemsresults.dat. If you are planning to execute a long running load test, you need to be sure that the loadtestitemsresults.dat file will be on a drive with enough disk space because it can grow into many GBs.

The loadtestitemsresults.dat file is created by the QTAgent or QTAgent32 process. You should add the key WorkingDirectory to QTAgent.exe.config and/or QTAgent32.exe.config to point to the right drive.

For example, add `<add key="WorkingDirectory" value="D:\Logs"/>` to the appSettings section.

For Visual Studio 2010, see <http://blogs.msdn.com/lkruger/archive/2009/06/08/visual-studio-team-test-load-agent-goes-64-bit.aspx> for more information about when QTAgent.exe or QTAgent32.exe is used.

Troubleshooting

How to enable logging for test recording

Changed in 2010

In 2008

You can create a log file of each recording which will show headers and post body as well as returned headers and response. The way to enable this is to add the following 2 keys:

```
[HKEY_CURRENT_USER\Software\Microsoft\VisualStudio\9.0\EnterpriseTools
\QualityTools\WebLoadTest]
```

```
"CreateLog"=dword:00000001      [NOTE: 1=create; 0=do not create]
"RecorderLogFolder"="C:\\recordlogs"
```

In 2010

The Web test recorder automatically logs the requests and responses. See the section [Recorder Log Available](#)

Diagnosing and fixing Web Test recorder bar issues

When you start recording a web test and the recorder bar is disabled or doesn't show up it can be hard to diagnose and fix the issue.

[Michael Taute's blog](#) provides a list with common reasons for this to happen and potential fixes for each. Most of the times the reasons are security related. One of the most common reasons for this problem is:

Issue: recorder bar comes up, but the controls are disabled.

Fix: the web test recorder bar does not work with Internet Explorer Enhanced Security Configuration (IE ESC) enabled. IE ESC can be removed from within the Control panel -> Add Remove Programs / Windows Components and uncheck ESC (Windows Server 2003, Vista).

Windows Server 2008 requires a different process to disable this security feature. Start the Server Manager, browse to the Security Information section and click Configure IE ESC. In the next window decide for whom you want to enable or disable this feature. For more details and screenshots:

<http://blogs.techrepublic.com.com/datacenter/?p=255>

User Account requirements and how to troubleshoot authentication

The following information comes from a blog entry by Durgaprasad Gorti. The link at the end of this section will take you to the full article which includes a walkthrough on troubleshooting authentication issues on a test rig.

Workgroup authentication

In a Microsoft® Windows® domain environment, there is a central authority to validate credentials. In a workgroup environment, there is no such central authority. Still, we should be able to have computers in a workgroup talk to each other and authenticate users. To enable this, local accounts have a special characteristic that allows the local security authority on the computer to authenticate a "principal" in a special way.

If you have two computers and a principal "UserXYZ" on both machines the security identifiers are different for MACHINE1\UserXYZ and MACHINE2\UserXYZ and for all practical purposes they are two completely different "Principals". However if the passwords are the same for them on each of these computers, the local security authority treats them as the same principal.

So when MACHINE1\UserXYZ tries to authenticate to MACHINE2\UserXYZ, and if the passwords are the same, then on MACHINE2, the UserXYZ is authenticated successfully and is **treated as MACHINE2\UserXYZ**. Note the last sentence. The user MACHINE1\UserXYZ is authenticated as MACHINE2\UserXYZ if the passwords are the same.

<http://blogs.msdn.com/dgorti/archive/2007/10/02/vstt-controller-and-agent-setup.aspx>

How to enable Verbose Logging on an agent for troubleshooting

If you need to have verbose logging to debug or isolate issues with the agents including IP switching, you can turn on verbose logging in the config files.

1. Go to **c:\Program files\Microsoft Visual Studio 2008 Team Test Load Agent\LoadTest** on the agent machine.
2. Edit the **QTAgentServiceUI.exe.config** file

- a. change the EqtTraceLevel to 4

```
<switches>
    <add name="EqtTraceLevel" value="4" />
```

- b. Change the CreateTraceListener value to yes

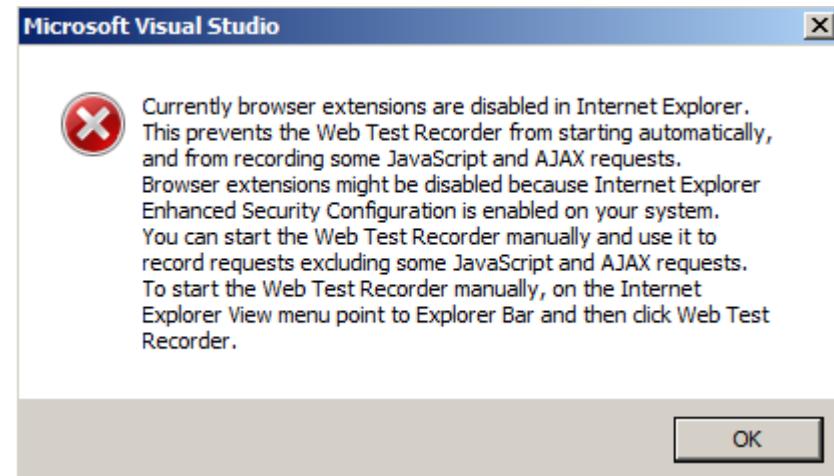
```
<appSettings>
    <add key="CreateTraceListener" value="yes"/>
```

The above settings also apply to the QTAgent.exe.config, QTController.exe.config and the QTControllerService.exe.config files.

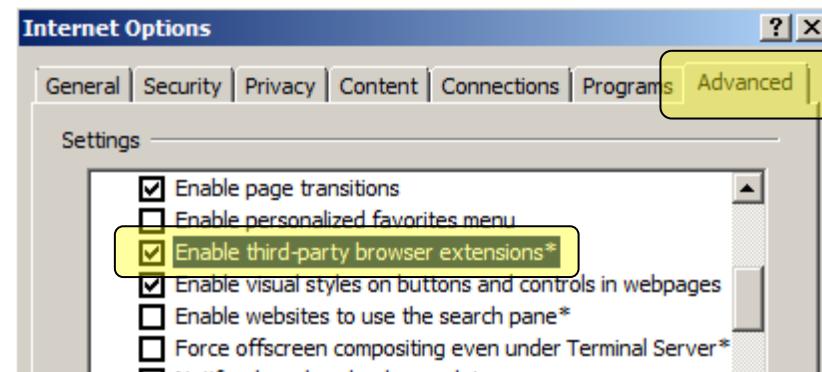
Note: These files have moved in VS 2010 to **C:\Program Files\Microsoft Visual Studio 10.0\Common7\IDE**.

Error that Browser Extensions are disabled when recording a web test

You might see the following error when trying to record a web test:



To fix this, go to “Tools” -> “Internet Options and set the following:



Troubleshooting invalid view state and failed event validation

ASP.NET uses __VIEWSTATE and __EVENTVALIDATION hidden fields to round-trip information across HTTP requests. The values for these fields are generated on the server and should be posted unchanged on a post back request. By default, these values are signed with a so-called validationKey to prevent tampering with the values on the client.

If you just record the values in a web test and post the recorded values, you can run into ASP.NET error messages about invalid view state or failed event validation. The Visual Studio web test recorder will normally automatically detect the __VIEWSTATE and __EVENTVALIDATION hidden fields as dynamic parameters. This means the dynamically extracted values will be posted back instead of the recorded values.

However, if the web server is load balanced and part of a web farm you may still run into invalid view state and failed event validation errors. This occurs when not all servers in the web farm use the same validationKey and the post back request is routed to a different server in the farm than the one on which the page was rendered.

To troubleshoot, ViewState MAC checking can be disabled by setting enableViewStateMac to false. However, this is not suitable for use on a production environment because it disables an important security feature and has performance implications. The recommended fix is to define the same value for the validationKey on all machines.

Instructions for manually creating a validationKey are detailed at <http://msdn.microsoft.com/en-us/library/ms998288.aspx>. For IIS 7 a machine key can easily be created through IIS Manager, see [http://technet.microsoft.com/en-us/library/cc772287\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc772287(WS.10).aspx).

For more background information on ViewState and EventValidation go to <http://msdn.microsoft.com/en-us/magazine/cc163512.aspx>.

Troubleshooting the VSTS Load Testing IP Switching Feature

1) Make sure that the Agent Service is running as a user than is an admin on the agent machine; this is required because the agent service attempts to configure the IP addresses specified in the agent properties on the chosen NIC, and admin permission is required to do this.

2) Make sure that none of the IP addresses in the range specified for a particular agent are already configured on the chosen NIC.

3) Enable verbose logging for the Agent Service:

* Edit the file QTAgentService.exe.config: (located at: <Program Files>\Microsoft Visual Studio 9.0 Team Test Load Agent\LoadTest\QTAgentService.exe.config)

* Change:

<add key="CreateTraceListener" value="no"/> to "yes"

* Change:

<add name="EqtTraceLevel" value="3" /> to "4"

* Restart the Load Test Agent service

* The file "VSTTAgent.log" will be created in the same directory as QTAgentService.exe.config.

* Re-run the load test with verbose logging configured, and look for lines in the log file that contain the text: "*Attempting to configure IP address:*" and "*Configured IP address:*" This will tell you whether or not you the agent service is attempting to configure the IP address you've specified. If you see the "*Configured IP address:*" line, it has succeeded in configuring this IP address. If not, there should be some error logged.

If you have verified the items in step 1 & 2 above, and the log indicates that the configuration of the IP address is failing but you cannot determine the cause of the failure from the error message in the log (or if there is no error message in the log), post a new thread to the Web and Load testing forum, or open a Microsoft Support incident for further assistance, and provide details on the setup including the relevant portions of the log file.

4) Make sure that the load test you are running is set to use IP Switching: Click on each of the "Scenario" nodes in the load test editor, go to the property sheet, and verify that the "IP Switching" property is set to True (normally it should be since this is the default, but it's worth checking).

5) Enable verbose logging for the Agent process.

If the log file created in step 3 shows that the IP addresses are being successfully configured, the next step is to check the agent process log file to verify that the load test is actually sending requests using those IP addresses.

To enable verbose logging for the agent process:

* Edit the file QTAgent.exe.config: (located at <Program Files>\Microsoft Visual Studio 9.0 Team Test Load Agent\LoadTest\QTAgent.exe.config)

* Change:

<add key="CreateTraceListener" value="no"/> to "yes"

* Change:

<add name="EqtTraceLevel" value="3"/> to "4"

* The file "VSTTAgentProcess.log" will be created in the same directory as QTAgent.exe.config.

* Re-run the load test, and look for lines in the log file that look something like: "*Bound request on connection group M to IP address NNN.NNN.NNN.NNN*" If verbose logging is enabled and these lines are present in the log file, IP Switching should be working.

6) If the number of unique IP addresses being used as shown by the log entries in step 5 is less than the number in the range that was configured, it could be because your load test is configured to use a connection pool with a smaller number of connections than the number of IP addresses specified. If this is the case, you can increase the size of the connection pool, or switch to "Connection per User" mode in the load test's run settings properties.

Troubleshooting Guide for Visual Studio Test Controller and Agent

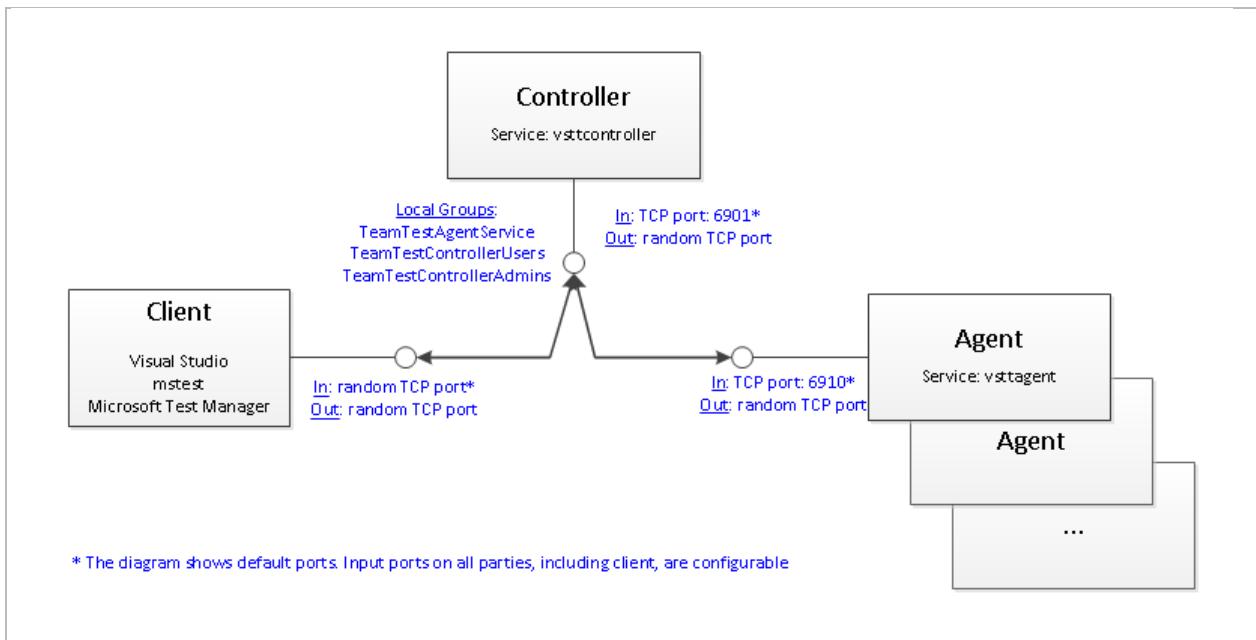
From: <http://social.msdn.microsoft.com/Forums/en-US/vststest/thread/df043823-ffcf-46a4-9e47-1c4b8854ca13>

This guide is to help troubleshoot connection issues between Visual Studio Test Controller and Agent as well as remote test execution issues. It gives an overview of main connection points used by Test Controller and Agent and walks through general troubleshooting steps. In the end it provides a list of common errors we have seen and ways to fix them, and a description of tools that can be useful for troubleshooting as well as how to obtain diagnostics information for test execution components.

We would like to use this guide as running document, please reply to this post to add your comments.

2. Remote Test Execution: connection points

The following diagram illustrates main connection points between Test Controller, Agent and Client. It outlines which ports are used for incoming and outgoing connections as well as security restrictions used on these ports.



The technology used to connect remote test execution components is .Net Remoting over Tcp ports. For incoming connections, by default, Test Controller uses Tcp port 6901 and Test Agent uses port 6910. The Client also needs to accept incoming connection in order to get test results from Controller, and, by default, it is using random port for that. For information on how to configure incoming ports, refer to the Tools section in Appendix. For outgoing connections random Tcp ports are used. For all incoming connections Test Controller authenticates calling party and checks that it belongs to specific security group.

All connectivity issues can be divided into 2 main groups: network issues and security/permission issues.

2.1. Network/Firewall issues (mainly implied by .Net Remoting technology):

- **Controller :**
 - Listens on TCP port 6901 (can be configurable to use different port).
 - Needs to be able to make outgoing connection to Agents and to the Client.
 - Needs incoming “File and Printer sharing” connection open.
- **Agent:**
 - Listens on TCP port 6910 (can be configurable to use different port).
 - Needs to be able to make outgoing connection to Controller.
- **Client:**
 - Needs to be able to accept incoming calls. Usually you would get Firewall notification when Controller tries to connect to Client 1^{st} time. On Windows 2008 Server the notifications are disabled by default and you would need to manually add Firewall exception for Client program (devenv.exe, mstest.exe, mlm.exe) so that it can accept incoming connections.
 - By default, random TCM port is used for incoming connections. If needed, the incoming port can be configured (see the Tools section in Appendix).
 - Needs to be able to make outgoing connection to Controller.

2.2. Permissions

There are two scenarios which are different by how Test Controller is operating, and the permissions used by Controller differ depending on the scenario:

- Test Controller runs as standalone: physical environments (VS2008 or VS2010).
- Test Controller is connected to TFS server: virtual environments (VS2010 only).

2.2.1. Permissions: Test Controller not connected to TFS server:

- To run tests remotely, Client user must belong to either TeamTestControllerUsers, or TeamTestControllerAdmins, or Administrators local group on Controller machine.
- To manage Controller/Agent, Client user must belong to TeamTestControllerAdmins or Administrators local group on Controller machine.
- Agent service account must belong to either TeamTestAgentService or Administrators local group on Controller machine.
- Controller service account must belong to either TeamTestControllerUsers or Administrators local group on Controller machine.
- Service accounts with empty/no passwords are not supported.

2.3. Connection Points: Summary

Review of the connections gives high level picture of what can fail in Test Controller/Agent connectivity. At this point you can already have a clear idea which requirement is not met for your specific scenario. Next section provides step-by-step troubleshooting.

3. Step-by-step troubleshooting

Let's walk through general troubleshooting procedure for Test Controller/Agent connection issues. For simplicity we'll do that in step-by-step manner.

Before following these steps you may take a look at Known Issues section in the Appendix to see if your issue is one of known common issues. The troubleshooting is based on the key connection points and in essence involves making sure that:

- The services are up and running.
- Permissions are set up correctly.
- Network connectivity/Firewall issues.

There are two scenarios which are different by how Test Controller is operating, and troubleshooting steps differ depending on the scenario; hence we will consider each scenario separately:

- Test Controller runs as standalone: physical environments (VS2008 or VS2010).
- Test Controller is connected to TFS server: virtual environments (VS2010 only).

3.1. Step-by-step troubleshooting: VS2008 or VS2010 physical environments

Pre-requisites. Make sure you have necessary permissions.

- Depending on what you need to troubleshoot, you may need Administrator permissions on Agent and/or Controller machines.

Step 1. Make sure that the Controller is up and running and Client can connect to Controller.

- Use Visual Studio or Microsoft Test Manager (see Tools section above) to view Controller status.
- If you can't connect to Controller, make sure that Controller service is running:
 - On Controller machine (you can also do that remotely) re/start controller service (see Tools section in Appendix).
- (if you still can't connect) On Controller machine make sure that it can accept incoming connections through Firewall
 - Open port 6901 (or create exception for the service program/executable).
 - Add Firewall Exception for File and Printer Sharing.
- (if you still can't connect) make sure that the user you run the Client under has permissions to connect to Controller:
 - On Controller machine, add Client user to the TeamTestControllerAdmins local group.
- (if you still can't connect) On Client machine make sure that Firewall is not blocking incoming and outgoing connections:
 - Make sure that there is Firewall exception for Client program (devenv.exe, mstest.exe, mlm.exe) so that it can accept incoming connections.
 - Make sure that Firewall is not blocking outgoing connections.
- (if you still can't connect)

- VS2010 only: the simplest at this time is to re-configure the Controller:
 - On Controller machine log on as local Administrator, run the Test Controller Configuration Tool (see Tools section above) and re-configure the Controller.
 - All steps should be successful.
- (if you still can't connect) Restart Controller service (see the Service Management commands section in Tools section above)

Step 2. Make sure that there is at least one Agent registered on Controller.

- Use Visual Studio (Manage Test Controllers dialog) or Microsoft Test Manager (see Tools section in the Appendix) to view connected Agents.
- If there are no Agents on the Controller, connect the Agent(s).
 - VS2010 only:
 - On Agent machine log in as user that belongs to TeamTestAgentServiceAdmins.
 - On Agent machine open command line and run the Test Agent Configuration Tool (see Tools section in the Appendix).
 - Check 'Register with Test Controller', type controller machine name and click on 'Apply Settings'.
 - VS2008 only:
 - In Visual Studio (Manage Test Controllers dialog) click on Add Agent.
 - You may need to restart the Agent service.

Step 3. Make sure that Agent is running and Ready (for each Agent)

Agent status can be one of: Ready/Offline (temporary excluded from Test Rig)/Not Responding/Running Tests.

- Use Visual Studio or Microsoft Test Manager (see Tools section in the Appendix) to check Agent status.
- If one of the Agents is not shown as Ready, make sure that Agent service is running:
 - On Agent machine (you can also do that remotely) re/start Agent service (see Tools section in the Appendix).
- (if Agent is still not Ready)
 - VS2010 only: the simplest at this time is to re-configure the Agent:
 - On Agent machine log on as local Administrator and run the Test Agent Configuration Tool (see Tools section in the Appendix) and re-configure the Agent.
 - All steps should be successful.
 - (if Agent is still not Ready)
 - If Agent is shown as Offline, select it and click on the Online button.

- On Agent machine make sure that agent service can accept incoming connections on port 6901 (if Firewall is on, there must be Firewall exception either for the port or for the service program/executable).
- Make sure that Agent service account belongs to the TeamTestAgentService on the Controller.
 - On Controller machine use Computer Management->Local Groups to add Agent user to the TeamTestAgentService group.
 - Restart services: Stop Agent service/Stop Controller service/Start Controller service/Start Agent service.
- Make sure that Agent machine can reach Controller machine (use ping).
- Restart Agent service (see the Service Management commands section in Tools section above).

Step 4. If all above did not help, it is time now to analyze diagnostics information.

- (VS2010 only) Agent/Controller services by default log errors into Application Event Log (see Tools section in the Appendix).
 - Check for suspicious log entries there.
- Enable tracing – see Diagnostics section above.
 - Get trace for the components involved in your scenario, some/all of:
 - Controller
 - Agent
 - Client
 - Test Agent/Controller Configuration Tool
 - Make sure that Controller/Agent service accounts have write access to trace files.
 - Check for entries starting with “[E”.

Step 5. Take a look at Known Issues section in the Appendix to see if your issue is similar to one of those.

Step 6. Collect appropriate diagnostics information and send to Microsoft (create [Team Test Forum](#) post or [Microsoft Connect](#) bug).

4. References

The following is a list of useful information sources related to Test Agent/Controller troubleshooting.

- [Troubleshooting Test Execution](#) in MSDN.
- [Troubleshooting Controllers, Agents and Rigs](#) (VS2008) in MSDN.
- [Installing and Configuring Visual Studio Agents](#) (VS2010) in MSDN.
- Understanding Visual Studio Load Agent Controller ([Load Test team blog](#)).
- Troubleshooting errors in lab management ([Team Lab blog](#)).
- [Visual Studio Team System – Test](#) Forum.
- [Microsoft Connect](#) – report bugs/suggestions.

Appendix 1. Tools

The following tools can be useful for remote execution/Agent/Controller troubleshooting:

- Visual Studio: Premium (VS2010 only), Team Test Edition (VS2008 only).
 - Manage Test Controllers dialog (Main menu->Test->Manage Test Controllers): see status of Controller and all connected Agents, add/remove Agents to Controller, restart Agents/the whole test rig, bring Agents online/offline, configure Agent properties.
Note: on VS2008 this dialog is called Administer Test Controllers.
 - Run tests remotely:
 - VS2008: update Test Run Configuration to enable remote execution (Main Menu->Test->Edit Test Run Configurations->(select run config)->Controller and Agent->Remote->provide Test Controller name), then run a test.
 - VS2010: update Test Settings to use remote execution role (Main Menu->Test->Edit Test Settings -> (select test settings)->Roles->Remote Execution), then run a test.
- Microsoft Test Manager (VS2010 only)
 - Lab Center->Controllers: see status of Controller and all connected Agents, add/remove Agents to Controller, restart Agents/the whole test rig, bring Agents online/offline, configure Agent properties. Note that Lab Center only shows controllers that are associated with this instance of TFS.
- Test Controller Configuration Tool (TestControllerConfigUI.exe, VS2010 only):
 - It is run as last step of Test Controller setup.
 - You can use it any time after setup to re-configure Controller. The tool has embedded diagnostics which makes it easier to detect issues.
- Test Agent Configuration Tool (TestAgentConfigUI.exe, VS2010 only):
 - It is run as last step of Test Controller setup.

- You can use it any time after setup to re-configure Agent. The tool has embedded diagnostics which makes it easier to detect issues.
- Diagnostics information
 - Both Agent and Controller can be configured to trace diagnostics information (from errors to verbose) to Application Event Log or trace file. Clients can also be configured to trace (from errors to verbose) to trace file.
 - Tracing can be enabled via .config file or registry (VS2010 only), registry wins. Choose the method that is more convenient for your scenario.
 - Enable tracing via .config file(s):
 - One of the advantages of using config files is that you can enable tracing for each component separately and using trace settings specific only to this component.
 - For Controller Service/Agent Service/Agent Process, you need the following sections in the corresponding .config file (qtcontroller.exe.config, qtagentservice.exe.config, qtagent.exe.config, qtagent32.exe.config which by default are located in C:\Program Files (x86)\Microsoft Visual Studio 10.0\Common7\IDE):
 - Inside the <appSettings> section:


```
<add key="CreateTraceListener" value="yes"/>
```
 - Inside the <configuration> section (note: “Verbose” is equivalent to “4”):


```
<system.diagnostics>
  <switches>
    <add name="EqtTraceLevel" value="Verbose" />
  </switches>
</system.diagnostics>
```
 - Trace files:
 - Controller: vsttcontroller.log
 - Agent Service: vsttagent.log
 - Agent Process: VSTTAgentProcess.log
 - For Client, add the following section to appropriate .config file (devenv.exe.config, mstest.exe.config, mlm.exe.config):
 - Inside the <configuration> section (note: “Verbose” is equivalent to “4”):


```
<system.diagnostics>
  <trace autoflush="true" indentsize="4">
    <listeners>
```

```

        <add name="EqtListener"
      type="System.Diagnostics.TextWriterTraceListener"
      initializeData="C:\EqtTrace.log" />
    </listeners>
  </trace>
  <switches>
    <add name="EqtTraceLevel" value="Verbose" />
  </switches>
</system.diagnostics>

```

- Trace file: trace will go to the file specified by the initializeData attribute.
 - **Important:** please make sure that the location is writable by controller/agent service/process.
- Enable tracing via registry (VS2010 only):
 - One of the advantages of using registry is that you can enable tracing for all components using just one setting, you don't have to modify multiple configuration files.
 - Create a file with the following content, rename it so that it has .reg extension and double click on it in Windows Explorer:

```

Windows Registry Editor Version 5.00
[HKEY_CURRENT_USER\Software\Microsoft\VisualStudio\10.0\EnterpriseTools
\QualityTools\Diagnostics]
"EnableTracing"=dword:00000001
"TraceLevel"=dword:00000004
"LogsDirectory"="C:\"
```

- Notes:
 - In case of Test Controller/Agent services the HKEY_CURRENT_USER is the registry of *the user the services are running under*.
 - TraceLevel: 0/1/2/3/4 = Off/Error/Warning/Info/Verbose.
 - LogsDirectory is optional. If that is not specified, %TEMP% will be used.
 - Trace file name is <Process name>.EqtTrace.log, e.g. devenv.EqtTrace.log.
- Tracing from Test Controller Configuration Tool and Test Agent Configuration Tool:
 - To get trace file, click on Apply, then in the “Configuration Summary” window on the view log hyperlink in the bottom.
- SysInternals’ DebugView can also be used to catch diagnostics information.
- Application configuration files
 - Controller, Agent and Client use settings from application configuration files:

- Controller service: qtcontroller.exe.config
- Agent service: qtagentservice.exe.config
- Agent process: qtagent.exe.config (neutral/64bit agent), qtagent32.exe.config (32bit agent).
- VS: Devenv.exe.config.
- Command line test runner: mstest.exe.config.
- By default these files are located in C:\Program Files (x86)\Microsoft Visual Studio 10.0\Common7\IDE.
- How to configure listening ports:
 - This may be useful in the following scenarios:
 - Default ports used by Controller/Agent/Client can be used by some other software.
 - There is firewall between controller and client. In this case you would need to know which port to enable in the firewall so that Controller can send results to the Client.
 - Controller Service: qtcontroller.exe.config:

```
<appSettings><add key="ControllerServicePort" value="6901"/></appSettings>
```

- Agent Service:


```
<appSettings><add key="AgentServicePort" value="6910"/></appSettings>
```
- Client: add the following registry values (DWORD). The Client will use one of the ports from this range for receiving data from Controller:

HKEY_LOCAL_MACHINE\SOFTWARE\MICROSOFT\VisualStudio\10.0\EnterpriseTools\QualityTools\ListenPortRange\PortRangeStart
HKEY_LOCAL_MACHINE\SOFTWARE\MICROSOFT\VisualStudio\10.0\EnterpriseTools\QualityTools\ListenPortRange\PortRangeEnd

- Service Management commands
 - UI: Start->Computer->Right-click->Manage-> Services and Applications->Services
 - § Visual Studio Test Controller
 - Visual Studio Test Agent
 - Command line: net start/net stop: use to start/stop Agent/Controller
 - net start vsttcontroller
 - net start vsttagent
- Windows Firewall

- Start->Control Panel->Windows Firewall.
- IP Security Policy
 - Start->Run->rsop.msc (on both Agent and Controller machines)
 - Go to Computer configuration->windows settings->security settings->ip security policies
 - Check if there are any policies that may prevent connections. By default there are no policies at all.
- Computer Management
 - Local Groups
 - Start->Computer->Manage->Local Users and Groups->Groups.
 - Event Log (Application)
 - Start->Computer->Manage->Event Viewer->Windows Logs->Application.
- Ping
 - You can use ping to make sure that general TCP/IP network connectivity works.
- Telnet
 - You can use telnet to check that you can connect to Agent/Controller, i.e. Firewall is not blocking, etc.
 - telnet <ControllerMachineName> 6901
 - telnet <AgentMachineName> 6910
- [Visual Studio Team System – Test](#) Forum.
- [Microsoft Connect](#) – report bugs/suggestions.

[Appendix 2. Known issues](#)

The following is a list of known issues and suggested resolutions for them.

[2.1. The message or signature supplied for verification has been altered \(KB968389\)](#)

Symptom: Agent cannot connect to Controller.

Affected scenarios: Windows XP/Windows 7 connecting to Windows 2003 Server.

Additional information:

- EventL Log (Agent): The message or signature supplied for verification has been altered.
- Trace file (Agent) contains:

```
I, <process id>, <thread id>, <date>, <time>, <machine name>\QTAgentService.exe,
AgentService: The message or signature supplied for verification has been altered.
I, <process id>, <thread id>, <date>, <time>, <machine name>\QTAgentService.exe,
AgentService: Failed to connect to controller.
Microsoft.VisualStudio.TestTools.Exceptions.EqtException: The agent can connect to the
controller but the controller cannot connect to the agent because of following reason:
An error occurred while processing the request on the server: System.IO.IOException:
The write operation failed, see inner exception. --->
System.ComponentModel.Win32Exception: The message or signature supplied for
verification has been altered
at System.Net.NTAuthentication.DecryptNtlm(Byte[] payload, Int32 offset, Int32 count,
Int32& newOffset, UInt32 expectedSeqNumber)
at System.Net.NTAuthentication.Decrypt(Byte[] payload, Int32 offset, Int32 count,
```

```

Int32& newOffset, UInt32 expectedSeqNumber)
at System.Net.Security.NegoState.DecryptData(Byte[] buffer, Int32 offset, Int32 count,
Int32& newOffset)
at System.Net.Security.NegotiateStream.ProcessFrameBody(Int32 readBytes, Byte[]
buffer, Int32 offset, Int32 count, AsyncProtocolRequest asyncRequest)
at System.Net.Security.NegotiateStream.ReadCallback(AsyncProtocolRequest asyncRequest)
--- End of inner exception stack trace ---
at System.Net.Security.NegotiateStream.EndRead(IAsyncResult asyncResult)
at
System.Runtime.Remoting.Channels.SocketHandler.BeginReadMessageCallback(IAsyncResult
ar)
Server stack trace:
at
Microsoft.VisualStudio.TestTools.Controller.AgentMachine.VerifyAgentConnection(Int32
timeout)

```

Root cause: You installed KB968389 either via Windows Update or manually.

Resolution: uninstall KB968389 from Start->Control Panel->Programs and Features->View Installed Updates.

2.2. Controller/Agent in untrusted Windows domains or one is in a workgroup and another one is in domain.

Symptom: Agent cannot connect to Controller.

Affected scenarios: Test Controller and Agent are not in the same Windows domain. They are either in untrusted domains or one of them is in a domain and another one is in a workgroup.

Additional information:

- Trace file (Agent) contains:

```

W, <process is>, <thread id>, <date>, <time>, <mMachine name>\QTController.exe,
Exception pinging agent <agent name>:
System.Security.Authentication.AuthenticationException: Authentication failed on the
remote side (the stream might still be available for additional authentication
attempts). ---> System.ComponentModel.Win32Exception: No authority could be contacted
for authentication
Server stack trace:
at System.Net.Security.NegoState.ProcessReceivedBlob(Byte[] message, LazyAsyncResult
lazyResult)
at System.Net.Security.NegotiateStream.AuthenticateAsClient(NetworkCredential
credential, ChannelBinding binding, String targetName, ProtectionLevel
requiredProtectionLevel, TokenImpersonationLevel allowedImpersonationLevel)
at System.Net.Security.NegotiateStream.AuthenticateAsClient(NetworkCredential
credential, String targetName, ProtectionLevel requiredProtectionLevel,
TokenImpersonationLevel allowedImpersonationLevel)
at
System.Runtime.Remoting.Channels.Tcp.TcpClientTransportSink.CreateAuthenticatedStream(
Stream netStream, String machinePortAndSid)
at
System.Runtime.Remoting.Channels.BinaryClientFormatterSink.SyncProcessMessage(IMessage
msg)

```

Root cause: Due to Windows security, Agent cannot authenticate to Controller, or vice versa.

Resolution:

- The simplest is to use Workgroup authentication mode:
 - Mirror user account on Controller and Agent: create a user account with same user name and password on both Controller and Agent machine.
 - Use mirrored user account to run Controller and Agent services under this account.
 - If you are using VS2010 RC+ version (i.e. RC or RTM but not Beta2), add the following line to the qtcontroller.exe.config file under the <appSettings> node:

```
<add key="AgentImpersonationEnabled" value="no"/>
```

- Restart Controller/Agent services (see Tools section in the Appendix).
- Make sure there is no IP Security Policy that prevents the connection (see IP Security Policy under Tools section in the Appendix).
 - By default for domain machines Windows uses domain (Kerberos) authentication, but if it fails it will fall back to workgroup (NTLM) authentication. This behavior can be and often is altered by IP Security policies, for instance, there could be a policy to block connections from machines which do not belong to the domain.
- Restart or re-configure Controller and Agent.

How To, Gotchas and Best Practices

How to call one coded web test from another

If you want to have two coded web tests and have one called from within the other, you need to follow a certain order to make it work:

1. Record the web tests
2. Generate code for the child
3. Include a call to the coded child in the declarative
4. Generate code for the parent

If you try to connect the two web tests before generating any code, your test will fail with the following error:

There is no declarative Web test with the name 'DrillDown_Coded' included in this Web test; the string argument to `IncludeWebTest` must match the name specified in an `IncludeDeclarativeWebTest` attribute.

How to use methods other than GET and POST in a web test

Summary

`FormPostHttpBody` and `StringHttpBody` are the two built-in classes for generating HTTP request bodies. If you need to generate requests containing something other than form parameters and strings then you can implement an `IHttpBody` class.

More information

<http://blogs.msdn.com/joshch/archive/2005/08/24/455726.aspx>

How to filter out certain dependent requests

Summary

One of the new Web Test features in Visual Studio 2008 is the ability to filter dependent requests. If you have a request in your web test that fetches a lot of content such as images, JavaScript files or CSS files, it's possible to programmatically determine which requests are allowed to execute during the course of the web test, and which aren't.

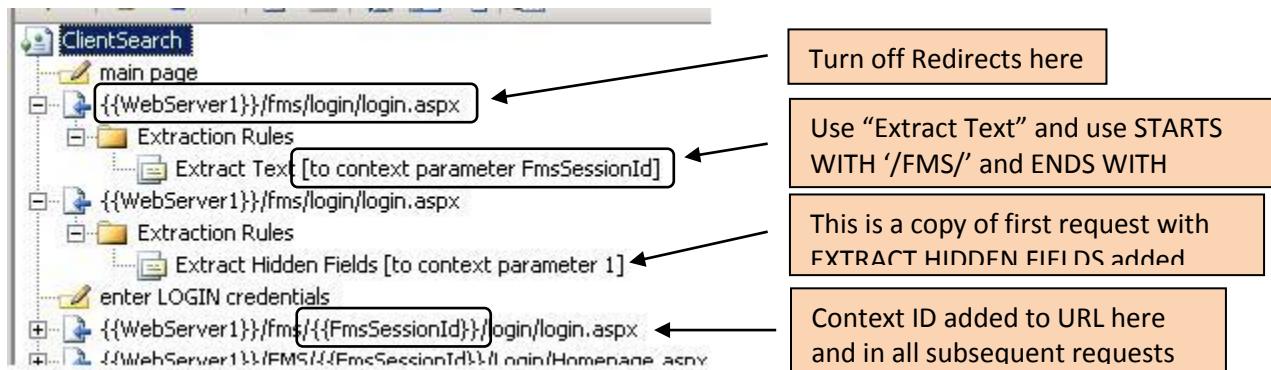
More information

<http://blogs.msdn.com/densto/pages/new-in-orcas-filtering-dependent-requests.aspx>

How to handle ASP.NET Cookie-less Sessions

ASP.NET allows session IDs to be passed as part of the URL requests, which can cause problems with VSTS playback. To deal with this issue, use the following steps:

1. Record the web test as normal
2. When the recording is done, you should see the very first request has no session ID in it, but all of the rest do. This first request also has a REDIRECT to the same URL, but with the session ID included.
3. For this request, turn off “Follow Redirects” and then add an extraction rule to get the value of the session (see example below).
4. Since you turned off redirects on the first request, you need to add a second request manually to the redirected page to capture any HIDDEN parameters.
5. Use “Quick Replace” to change all other hard-coded session IDs to the context you extracted in step 3



How to use extracted values inside Web Request URLs

How to use Client-side certificates in web tests

Client-side certificates are also supported in web tests, but additional code is required. The certificates need to be added to the `WebTestRequest.ClientCertificates` collection. This can be done in a coded web test, or by using a request plug-in in a declarative web test.

The following link describes how to use X509 certificate collections to make a SOAP request in .NET; code for using them in a web test will be similar.

More information

<http://msdn.microsoft.com/en-us/library/ms819963.aspx>

How to remove the “If-Modified-Since” header from dependent requests

The reason that If-Modified-Since headers are sent by default with dependent requests is that the web test engine attempts to emulate the behavior of Internet Explorer in its default caching mode. In many cases IE will send If-Modified-Since headers.

However, with VSTS 2008 if you want to completely disable caching of all dependent requests and always fetch them, you can do so with the following WebTestPlugin:

```
public class WebTestPlugin_DisableDependentCaching : WebTestPlugin
{
    public override void PostRequest(object sender, PostRequestEventArgs e)
    {
        foreach (WebTestRequest dependentRequest in e.Request.DependentRequests)
        {
            dependentRequest.Cache = false;
        }
    }
}
```

How to handle custom data binding in web tests

Changed in 2010

In 2008

Summary

It is possible to create a custom data binding to bind to something other than a table, such as a select statement. This blog post describes one possible method – creating one class which will manage the data and creating a web test plug-in to add the data into the web test context.

More information

<http://blogs.msdn.com/slumley/pages/custom-data-binding-in-web-tests.aspx>

In 2010

<http://blogs.msdn.com/slumley/archive/2010/01/04/vsts-2010-feature-data-source-enhancements.aspx>

How to add a datasource value to a context parameter

If you try to assign a datasource value to a context parameter in a web test, it will not work properly. This is because VSTT does not replace datasource values in the context parameters. To work around this, you can add code directly into a coded web test or in a web test plugin. Use the following syntax for adding the binding:

```
this.Context.Add("ContextNameToUse",this.Datasource1["ColumnToUse"]);
```

How to test Web Services with Unit Tests

If you need some help or a starting point for building Web Service tests using Unit tests, the below blog gives a great walkthrough.

<http://blogs.msdn.com/slumley/pages/load-testing-web-services-with-unit-tests.aspx>

How to add random users to web tests

The following code can be used to generate random users for loading up sample sites with user accounts. The key to this is to randomize against a time stamp and to add another unique number (in this case, the vuser ID) so that two different instances of the load test won't accidentally try to insert the same user. Issues can occur where multiple agent machines randomly generate the same user when under heavy load. The code below does not guarantee you'll never hit identical accounts, but it significantly increases the chance of never hitting it.

```
public string sRndName = "User";
public string sRndExt = @"@contoso.lab";
public int x,y;
public string sUserName;

// Generate our random user
Random randObj = new Random();
x = randObj.Next();
y = this.Context.WebTestId;
sUserName = sRndName + Convert.ToString(x) + Convert.ToString(y) +
sRndExt;
```

Or, in a declarative test this can be achieved by setting the username value to:

```
UserName{ ${Random(0,10000)} }{ ${WebTestId} }UserNameExt
```

How to add think time to a Unit Test

When you use a web test, the VSTS environment provides a property for each request called ThinkTime. This is the preferred method to use. However, there is no such property for Unit Tests. In order to simulate think time within Unit Tests, use the Windows API “Sleep” and pass in the appropriate value (the parameter for sleep is in milliseconds, so use 1000 to simulate 1 second of sleep time). The Sleep API will work well here because it is a non-CPU intensive API. The reason it is NOT recommended for web tests is because it is a blocking API and more than one web test can share a thread, therefore it can adversely affect more than one vuser. Unit tests do not share threads, therefore they are not affected by this.

How to add details of a validation rule to your web test

There are no properties on the WebTestResponse object or WebTestRequest object that indicate the outcome of a specific validation rule. The best approach is to have the validation rule place the result text in the WebTestContext, and then access the WebTestContext object from the WebTest object's Context property in the PostRequest or PostWebTest event handler. The following approach should work. If you have multiple validation rules, you may want to use different names for the key on the call to this.Context.Add.

```
public class WebTest13Coded : WebTest
{
    public WebTest13Coded()
    {
        this.PreAuthenticate = true;
    }
    public override IEnumerator<WebTestRequest> GetRequestEnumerator()
    {
        WebTestRequest request1 = new WebTestRequest("http://vsncts01/StoreCSV");
        request1.ExpectedResponseUrl = "http://vsncts01/StoreCSV/";
        if ((this.Context.ValidationLevel >=
Microsoft.VisualStudio.TestTools.WebTesting.ValidationLevel.High))
        {
            // request1.ValidateResponse += new
EventHandler<ValidationEventArgs>(validationRule2.Validate);
            // Specify a wrapper validation event handler ...
            request1.ValidateResponse += new
EventHandler<ValidationEventArgs>(request1_ValidateResponse);
        }
        yield return request1;
        request1 = null;

        // Check the validation rule result of the previous request
        if ((bool)(this.Context["validationRule_Passed"]))
        {
            WebTestRequest request2 = new
WebTestRequest("http://vsncts01/testwebsite");
            yield return request2;
        }
    }

    private void request1_ValidateResponse(object source, ValidationEventArgs
validationEventArgs)
    {
        ValidationRuleRequiredAttributeValue validationRule = new
ValidationRuleRequiredAttributeValue();
        validationRule.TagName = "DIV";
        validationRule.AttributeName = "id";
        validationRule.MatchAttributeName = "id";
        validationRule.MatchAttributeValue = "LeftContent";
        validationRule.ExpectedValue = "LeftContent";
        validationRule.IgnoreCase = false;
        validationRule.Index = -1;

        validationRule.Validate(source, validationEventArgs);

        // Add the validation rule result to the WebTestContext
        this.Context.Add("validationRule_Passed", validationEventArgs.IsValid);
        this.Context.Add("validationRule_Message", validationEventArgs.Message);
    }
}
```

How to mask a 404 error on a dependent request

When running web tests, you may find that certain dependent requests always fail with a 404 error.

Normally you would resolve this issue by fixing the broken link, or removing the reference. However, sometimes (for the sake of moving forward with your testing) you might want to have VSTT ignore the error. Ed Glas has a blog outlining one way to do this quickly

(<http://blogs.msdn.com/edglas/archive/2008/08/06/masking-a-404-error-in-a-dependent-request.aspx>)

but that may not work in all cases. For example if an ASPX page has some code that returns a link to a local file that is not present, then the blog post above will not work. In this case, you should consider using a plugin similar to the following (thanks to Ed Glas for the sample):

```
//*****
// WebTestDependentFilter.cs
// Owner: Ed Glas
//
// This web test plugin filters dependents from a particular site.
// For example, if the site you are testing has ads served by another company
// you probably don't want to hit that site as part of a load test.
// This plugin enables you to filter all dependents from a particular site.
//
// Copyright(c) Microsoft Corporation, 2008
//*****
using Microsoft.VisualStudio.TestTools.WebTesting;

namespace SampleWebTestRules
{
    public class WebTestDependentFilter : WebTestPlugin
    {
        string m_startsWith;
        public string FilterDependentRequestsThatStartWith
        {
            get { return m_startsWith; }
            set { m_startsWith = value; }
        }

        public override void PostRequest(object sender, PostRequestEventArgs e)
        {
            WebTestRequestCollection depsToRemove = new WebTestRequestCollection();

            // Note, you can't modify the collection inside a foreach, hence the
            second collection
            // requests to remove.
            foreach (WebTestRequest r in e.Request.DependentRequests)
            {
                if (!string.IsNullOrEmpty(FilterDependentRequestsThatStartWith) &&
                    r.Url.StartsWith(FilterDependentRequestsThatStartWith))
                {
                    depsToRemove.Add(r);
                }
            }
            foreach (WebTestRequest r in depsToRemove)
            {
                e.Request.DependentRequests.Remove(r);
            }
        }
    }
}
```

How to parameterize Web Service calls within Web Tests

By default, VSTS does not expose an automated way of parameterizing the data passed in the body of a Web Service call. However, it does still honor the syntax used to define parameters in the string. To manually add a parameter definition in the body, edit the string and add the parameters where you need them. The syntax is:

```
{{Datasource.Table.Column}}
```

Here is a sample:

```
<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <OrderItem xmlns="http://tempuri.org/">
            <userName>jb@ibuyspy.com</userName>
            <password>IBS_007</password>
            <productID>{{DataSource.Products.ProductID}}</productID>
            <quantity>1</quantity>
        </OrderItem>
    </soap:Body>
</soap:Envelope>
```

How to pass Load Test Context Parameters to Unit Tests

<http://blogs.msdn.com/slumley/archive/2006/05/15/passing-load-test-context>

How to create Global Variables in a Unit Test

If you need to have a global variable shared among iterations of a unit test, use the following:

Define a static member variable of the unit test class, or if you have multiple unit test classes that need to share the data, create a singleton object that is accessed by all of the unit tests. The only case in which this would not work is if you have multiple unit test assemblies being used in the same load test that all need to share the global data and you also need to set the “Run Unit Tests in Application Domain” load test setting to true. In that case each unit test assembly has its own app domain and its own copy of the static or singleton object.

CAVEAT: This will not work in a multi-agent test rig. If you have a multi-agent rig and you want truly global data, you'd either need to create a common Web service or use a database that all of the agents access.

How to use Unit Tests to Drive Load with Command Line Apps

The following code can be used in a Unit Test to drive a command line tool (such as a testing tool). The Unit test can then be driven by a load test to emulate multiple copies of the app.

```
using System.Threading;
using System.Diagnostics;
using System.IO;
.....
[TestMethod]
public void TestMethod1()
{
    int x=0;
    int iDuration = 10000;

    try
    {
        Process myProcess = new Process();
        myProcess = Process.Start("c:\\temp\\conapp2.exe", "arg1", "arg2");

        myProcess.WaitForExit(iDuration); //Max iDuration milliseconds to return

        if (!myProcess.HasExited) //If the app has not exited, kill it manually
        {
            myProcess.Kill();
            Console.WriteLine("Application hung and was killed manually.");
        }
        else
        {
            x = myProcess.ExitCode;
            Console.WriteLine("Completed. Exit Code was {0}", x);
        }
    }
    catch (Exception e)
    {
        Console.WriteLine("The following exception was raised: " + e.Message);
    }
    finally
    {
    }
}
```

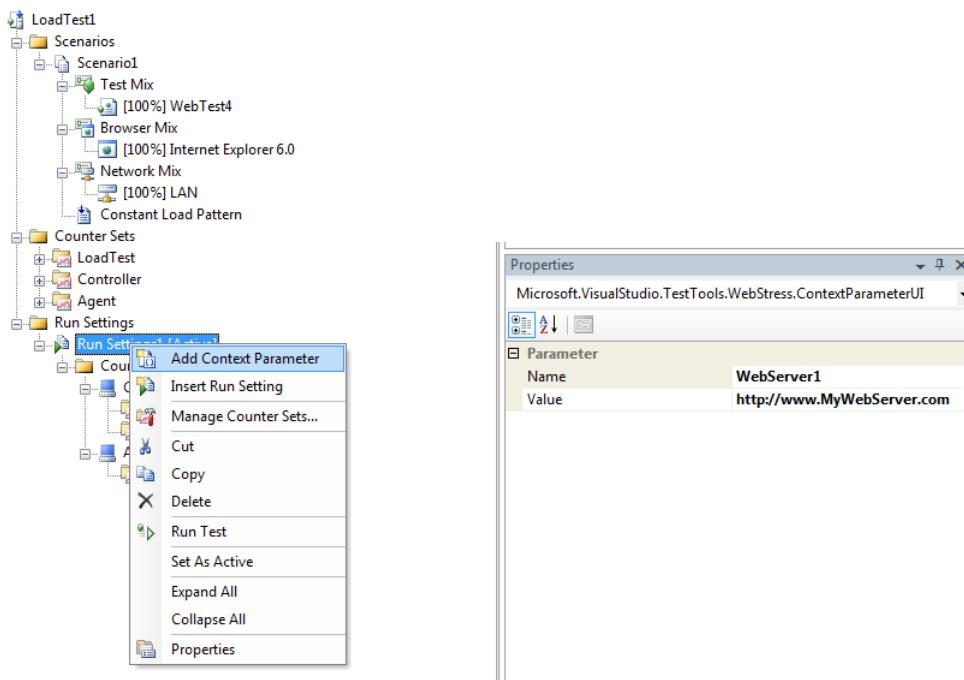
How to add Console Output to the results store when running Unit tests under load

The following link points to a write-up on how to allow unit tests to write custom output messages to the Load Test Results Store database from Unit tests while they are running in a load test:

<http://blogs.msdn.com/billbar/pages/adding-console-output-to-load-tests-running-unit-tests.aspx>

How to add parameters to Load Tests

To add a parameter to a Load Test, open the load test and right-click on the “Run Settings1” line (or wherever you want to add the parameter) and then choose to add a context parameter. Make sure it uses the same name as the parameter you wish to override in the web tests if that is your intent.



Adding parameters to load tests

How to Change the Standard Deviation for a NormalDistribution ThinkTime

Find the <test_name>.loadtest file in the VSTT project directory and edit it directly. You will find a section like the one below for each scenario in the loadtest. Change the ThinkProfile Value to whatever standard deviation you wish to use. The default value in VSTT is 20% (0.2)

```
<Scenario Name="Scenario1" DelayBetweenIterations="2"
PercentNewUsers="0" IPSwitching="true"
TestMixType="PercentageOfTestsStarted">
<ThinkProfile Value="0.2" Pattern="NormalDistribution" />
```

Any ThinkTime that has a value of zero will remain zero regardless of the distribution settings.

How to programmatically access the number of users in Load Tests

In a load test plug-in, you can get the current user load. For an example of this, see Ed Glas's blog post at: <http://blogs.msdn.com/edglas/archive/2006/02/06/525614.aspx> (listed as "Custom Load Patterns for VSTS" in the offline pages collection). This blog post actually does much more than that, but the line where it updates the current load is:

```
((LoadTestScenario)m_loadTest.Scenarios[0]).CurrentLoad = newLoad;
```

In VS 2008 SP1 and later, you can access the load profile using the LoadTestScenario.LoadProfile property, and casting this to the appropriate LoadProfile class (such as LoadTestConstantLoadProfile).

How to create a webtest plugin that will only execute on a predefined interval

If you want to write a webtest plugin that will only fire on certain intervals (maybe for polling or reporting), then use the following as a starting point.

```
public class WebTestPluginActingInfrequently : WebTestPlugin
{
    public override void PostWebTest(object sender, PostWebTestEventArgs e)
    {
        if (e.WebTest.Context.WebTestIteration % 100 == 1)
        {
            // Do something
        }
    }
}
```

The WebTestIteration property is guaranteed to be unique, so no need to worry about locking. If you run this web test by itself it will "do something" because the WebTestIteration will be 1 (unless you run the web test by itself with multiple iterations or data binding).

Rather than hard coding the frequency as 1 in 100, you could make the frequency a property of the plugin that you set in the Web test editor, or a Web test context parameter or a load test context parameter: the LoadTestPlugin would need to pass that down to the WebTestPlugin either by setting it in the WebTestContext or just make the frequency a property on the plugin.

Note that the WebTestIteration property is incremented separately for each Scenario (on each agent) in the load test, but if you want the frequency to be across all Web iterations on an agent then you could define a static int in the WebTestPlugin (and use Interlocked.Increment to atomically increment it).

How to support Context Parameters in a plug-in property

If you develop a plug-in or an extraction rule and you want to allow the properties you expose to be Context Parameters that the user specifies you need to add some code to your plugin to check for the existence of a **Context Parameter** using the curly brace ‘{{xyz}}’ syntax.

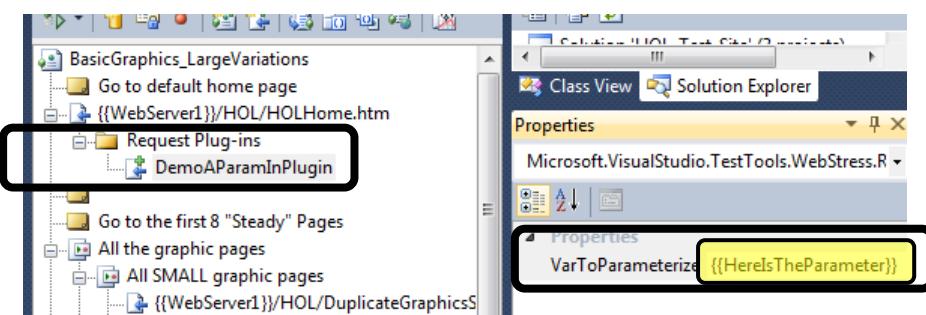
For example suppose the user had a Context Parameter {{ComparisonEventTarget}} that they want to provide as the property value for the **EventTarget** property in your plugin, (see the screen shot), then use the following code snippet to have your extraction/plugin checks the value supplied to determine if it contains the syntax “{{”.

Here is a partial code snippet:

```
public class DynamicFormFields : WebTestRequestPlugin
{
    // this is our property that is exposed in the Visual Studio UI
    // we want to allow either supplying a string literal, or a context
    parameter name
    public string EventTarget {get;set;}

    public override void PreRequest(object sender, PreRequestEventArgs e)
    {
        // we will check to see if our EventTarget is a string or do
        // they want us to get it from a context param
        if ( this.EventTarget.Contains("{{") )
        {
            string contextParamKey = this.EventTarget.Replace("{{",
                string.Empty).Replace("}}", string.Empty);

            this.EventTarget =
e.WebTest.Context[contextParamKey].ToString();
        }
        // . . . . . code to do your work starts here...
    }
}
```



How to stop a web test in the middle of execution

If you want to stop a web test in the middle of execution based on a certain condition, you can hook into a couple of methods (**GetRequestEnumerator** or **PostRequestEvent**) and use the following code to stop the execution:

Coded Web Test

```
if (<condition>)
{
    this.Stop();
    yield break;
}
```

WebTest Plugin (Note the caveat for this from the entry: "How to stop a test in the PreRequest Event)

```
{
    e.WebTest.Stop();
}
```

How To: Modify the ServicePointManager to force SSLv3 instead of TLS (Default)

If you need to modify the type of SSL connection to force **SSLv3** instead of **TLS** (Default) then you must modify the **ServicePointManager.SecurityProtocol** property to force this behavior. This can happen if you are working with a legacy server that requires an older SSLv3 protocol and cannot negotiate for the higher TLS security protocol. In addition, you may need to write code in your test to handle the **ServerCertificateValidationCallback** to determine if the server certificate provided is valid. A code snippet is provided below.

```
[TestMethod]
public void TestMethod1()
{
    // We're using SSL3 here and not TLS. Without this line, nothing works.
    ServicePointManager.SecurityProtocol = SecurityProtocolType.Ssl3;
    //we wire up the callback so we can override the behavior, force it to
    accept the cert from the server.
    ServicePointManager.ServerCertificateValidationCallback =
    RemoteCertificateValidationCB;

----- <XX SNIPPED XX> -----

    public static bool RemoteCertificateValidationCB(Object sender, X509Certificate
certificate, X509Chain chain, SslPolicyErrors sslPolicyErrors)
    {
        //If it is really important, validate the certificate issuer here.
        //string resultsTrue = certificate.Issuer.ToString(true);
        //For now, accept any certificate
        return true;
    }
}
```

How To: Stop a Test in the PreRequest event

Stopping a test using the **WebTest.Stop()** method in the **PreRequest** event will not stop the current request from executing. If you wish to stop the current request from firing then you need to set the current request Instruction property to **WebTestExecutionInstruction.Skip** and then issue the **WebTest.Stop()**.

```
void MSDNSiteCoded_PreRequest(object sender, PreRequestEventArgs e)
{
    e.Instruction = WebTestExecutionInstruction.Skip;
    e.WebTest.Stop();
}
```

How to make a validation rule force a redirection to a new page

Suppose you have a scenario in which you have a custom validation rule which detects an error condition. When you hit that error condition, you want to redirect to a new error page. Here are three ways to accomplish this.

coded test.

In a coded test, you can easily add new requests that get returned in the body of the test. You would just create a new **WebTestRequest** object and “yield return” it. For example if the rule adds a context parameter called **ErrorUrl**, you would have following in code:

```
if(this.Context.ContainsKey("ErrorUrl"))
{
    WebTestRequest request4 = new
        WebTestRequest(this.Context["ErrorUrl"].ToString());
    request4.Encoding = System.Text.Encoding.GetEncoding("utf-8");
    yield return request4;
    request4 = null;
}
```

Validation rule.

First you will need to add a dummy request after the page you want to check. The URL is not important because you are going to change it based on outcome of the validation rule. In your validation rule set a context parameter that contains the URL you want to redirect to. Here is a very simple rule that does this. If return code is great than 400, it adds the URL to the context. In this case, it is just redirecting to home page of the site.

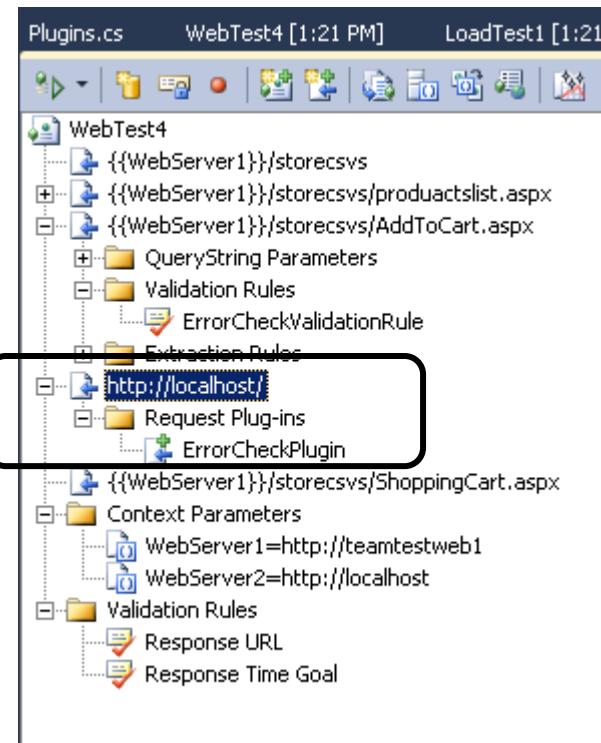
```
public class ErrorCheckValidationRule : ValidationRule
{
    public override void Validate(object sender, ValidationEventArgs e)
    {
        if (((int) e.Response.StatusCode) >= 400)
        {
            e.WebTest.Context.Add("ErrorUrl",
                e.WebTest.Context["WebServer1"].ToString() + "/storecsvs/");
        }
    }
}
```

WebTestRequestPlugin

First you will need to add a dummy request after the page you want to check. The URL is not important because you are going to change it in the plugin. Add a WebTestRequestPlugin to the dummy request. The plug-in will look for the parameter and if it exists, it will change URL of request. If the parameter does not exist, it will set the skip instruction for the request. Here is a simple plug-in which does this:

```
public class ErrorCheckPlugin : WebTestRequestPlugin
{
    public override void PreRequest(object sender, PreRequestEventArgs e)
    {
        object errorUrl;
        if (e.WebTest.Context.TryGetValue("ErrorUrl", out errorUrl))
        {
            e.Request.Url = errorUrl.ToString();
        }
        else
        {
            //if it does not exist then skip the request
            e.Instruction = WebTestExecutionInstruction.Skip;
        }
    }
}
```

Here is what the web test looks like: The dummy request is <http://localhost>.



Here is what the result looks like when it is skipped. You can see the status of Not Executed:

The screenshot shows a list of requests from a web test named 'WebTest4'. The first seven requests have passed successfully, indicated by green checkmarks and status codes (301, 200, 200, 302, 200, 200, 200). The eighth request, 'http://localhost/' (highlighted with a blue border), has a status of 'Not Executed' (highlighted with a red box). The ninth request, 'http://teamtestweb1/storecsvs/ShoppingCart.aspx' (highlighted with a blue border), has a status of '200 OK' (highlighted with a red box).

Request	Status
✓ http://teamtestweb1/storecsvs	301 Moved Permanently
✓ + http://teamtestweb1/storecsvs/	200 OK
✓ + http://teamtestweb1/storecsvs/productslist.aspx	200 OK
✓ - http://teamtestweb1/storecsvs/AddToCart.aspx	302 Found
✓ + http://teamtestweb1/storecsvs/ShoppingCart.aspx	200 OK
→ http://localhost/	Not Executed
✓ + http://teamtestweb1/storecsvs/ShoppingCart.aspx	200 OK

a. Here is what it looks like when it does the redirect:

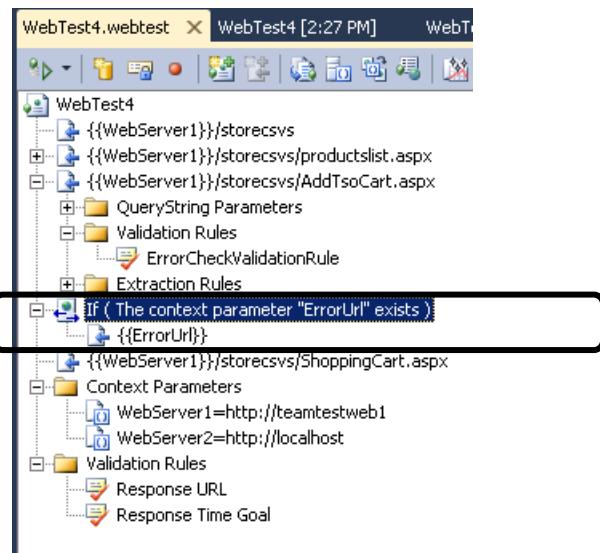
The screenshot shows a list of requests from a web test named 'WebTest4'. The first six requests have passed successfully (green checkmarks, status 301, 200, 200, 301, 200, 200). The seventh request, 'http://teamtestweb1/storecsvs/AddToCart.aspx' (highlighted with a blue border), has a status of '404 Not Found' (highlighted with a red box). The eighth request, 'http://teamtestweb1/storecsvs/' (highlighted with a blue border), has a status of '200 OK' (highlighted with a red box). The ninth request, 'http://teamtestweb1/storecsvs/ShoppingCart.aspx' (highlighted with a blue border), has a status of '200 OK' (highlighted with a red box).

Request	Status
✓ http://teamtestweb1/storecsvs	301 Moved Permanently
✓ + http://teamtestweb1/storecsvs/	200 OK
✓ + http://teamtestweb1/storecsvs/productslist.aspx	200 OK
✗ http://teamtestweb1/storecsvs/AddToCart.aspx	404 Not Found
✓ + http://teamtestweb1/storecsvs/	200 OK
✓ + http://teamtestweb1/storecsvs/ShoppingCart.aspx	200 OK

A solution for VS 2010 using the new conditional rule logic that works for declarative editor. In VS 2010 you can now do branching and looping in declarative editor. So instead of a web test request plug-in, we can do the redirect with a conditional rule. So you would do the following:

1. Add the validation rule to a request.
2. Still add the dummy request below the one that the validation rule is on
3. Set the URL for this dummy request to {{ErrorUrl}}
4. Right click on this request and choose "Insert Condition..."
5. Choose the Context Parameter Exists rule
6. Set the context parameter Name to ErrorUrl. This rule will execute if the ErrorUrl parameter is in the context.
7. Click Ok

Here is what editor looks like with the conditional rule:



Here is what it looks like when the condition is met.

Request		Status
✓	http://teamtestweb1/storecsvs	301 Moved Permanently
✓	+ http://teamtestweb1/storecsvs/	200 OK
✓	+ http://teamtestweb1/storecsvs/productslist.aspx	200 OK
✗	http://teamtestweb1/storecsvs/AddToCart.aspx	404 Not Found
✓	- If (The context parameter "ErrorUrl" exists)	Condition Met
✓	+ http://teamtestweb1/storecsvs/	200 OK
✓	+ http://teamtestweb1/storecsvs/ShoppingCart.aspx	200 OK

Here is what it looks like when condition is not met:

Request		Status
✓	+ http://teamtestweb1/storecsvs/	200 OK
✓	+ http://teamtestweb1/storecsvs/productslist.aspx	200 OK
✓	- http://teamtestweb1/storecsvs/AddToCart.aspx	302 Found
✓	+ http://teamtestweb1/storecsvs/ShoppingCart.aspx	200 OK
!	- If (The context parameter "ErrorUrl" exists)	Condition Not Met
✗	+ {ErrorUrl}	Not Executed
✓	+ http://teamtestweb1/storecsvs/ShoppingCart.aspx	200 OK

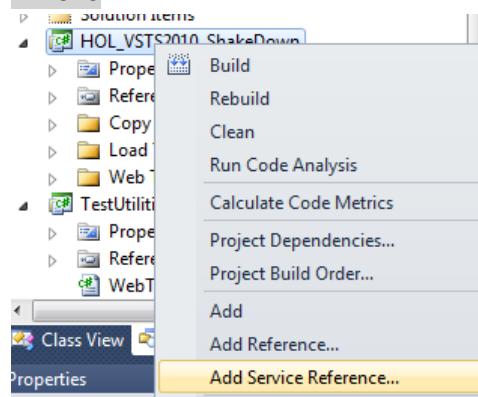
How to add a Web Service reference in a test project

If you follow along Sean Lumley's blog (<http://blogs.msdn.com/slumley/pages/load-testing-web-services-with-unit-tests.aspx>), as referenced in the cheat sheet, you'll see that step 2 is to create a New Web Reference. Unfortunately, right-clicking on either the project or references does not give you the option for Add Web Reference. To add the reference, add a service reference:

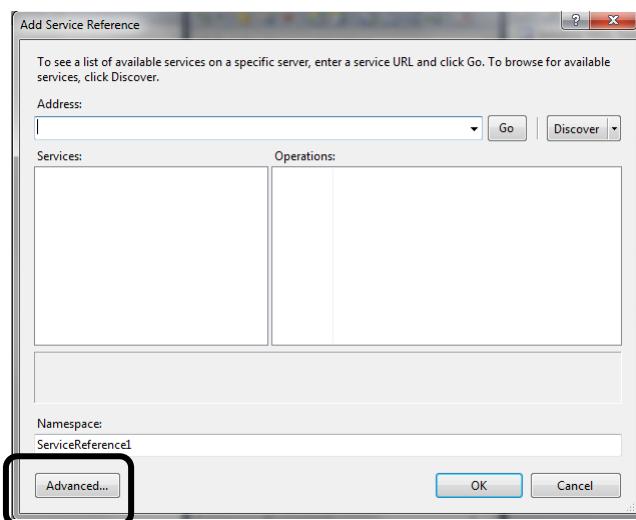
In 2008

<http://blogs.msdn.com/slumley/pages/load-testing-web-services-with-unit-tests.aspx>

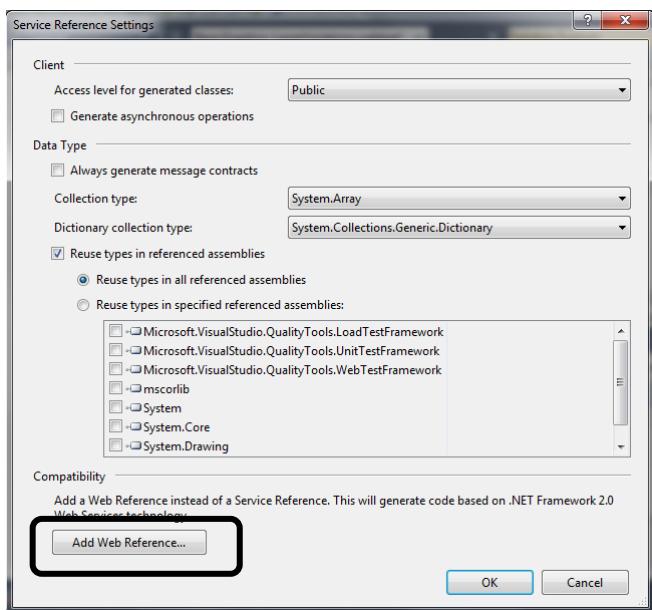
In 2010



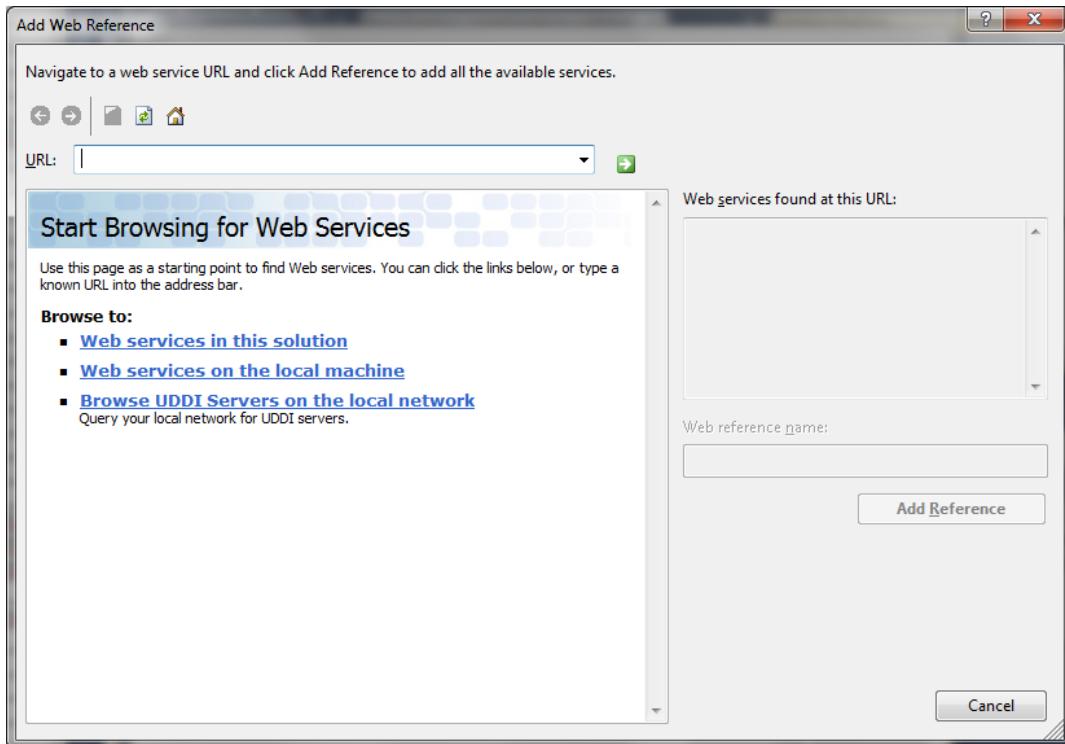
In the dialog, click on the “Advanced” button:



In the “Advanced” dialog, click the “Add Web Reference...” button



You will get the following dialog and can add the reference there:



How to remotely count connections to a process

If you are troubleshooting connectivity issues, you may need to count connections to a particular process over a particular port. You can easily do this using TCPVCON.EXE and a filter:

```
D:\>TcpView>Tcptvcon.exe -c smsvchost.exe | find "808" /c
```

TCPVCON is a sysinternals tool that is part of “**TCPView**” and can be downloaded from:

<http://technet.microsoft.com/en-us/sysinternals/bb795532.aspx>

If you need to run this command (or others) remotely, you can also look at the tool “**PsTools**” at the same web page.

How to hook into LoadTest database upon completion of a load test

You might want to run automatic custom actions after the completion of a load test, for example doing some automated reporting. To do this, you must change the **LoadTest** database used by Visual Studio. For Visual Studio 2010 the default name of the database is **LoadTest2010**.

The stored procedure

- **Prc_UpdateSummaryData** [In 2008]
- **Prc_UpdateSummaryData2** [In 2010]

is the last one that is called when the load test finishes, assuming the **Timing Details Storage** is set to something other than **None** in the **Run Settings** for your load test.

You can change this stored procedure by appending a call to your own stored procedure that implements or starts your custom action. That stored procedure could be implemented as .NET code by employing a CLR SQL Stored Procedure (see <http://msdn.microsoft.com/en-us/library/5czye81z.aspx>).

NOTE: changing the LoadTest database is an unsupported action that might interfere with automatic upgrades to new versions of the database schema.

How to deploy DLLs with MSTEST.EXE

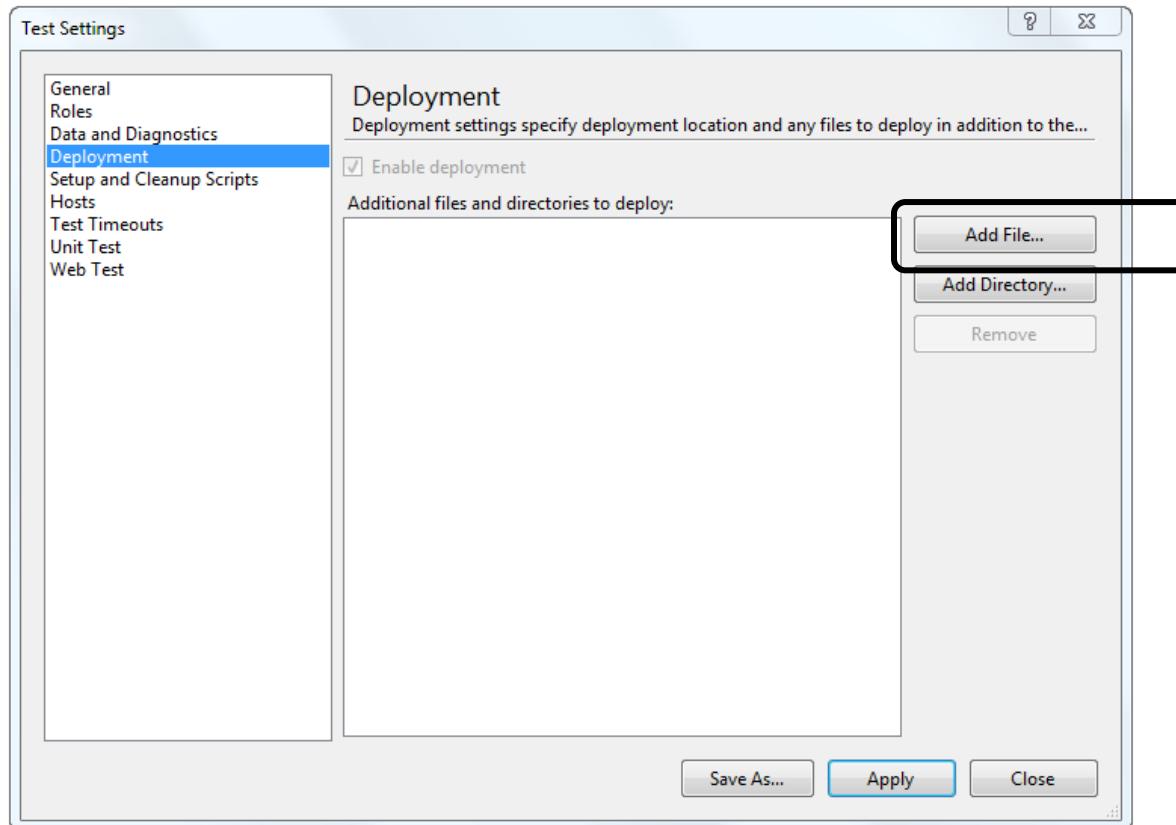
Changed in 2010

You can use MSTEST.EXE to start your load test outside Visual Studio. In that case you might run into errors with missing DLLs for plugins that you do not encounter when running your load test inside Visual Studio. Visual Studio looks at references to figure out what to deploy, while MSTEST.EXE does not. To fix this you have to manually add the DLLs as deployment items in the test settings (VS2010) or test run configuration file (VS2008).

Select the test settings file that you want to use with MSTEST.EXE. This will be one of the files in the Solution Items folder of your solution with the

- **.testsettings** extension [In 2010]
- **.testrunconfig** extension [In 2008]

Open it in the Test Settings Editor. Go to the Deployment page. Select “Add File...” and select the DLLs you want to deploy.



Specify the test settings file you have edited on the command line for MSTEST.EXE with the

- /testsettings switch [In 2010]
- /testrunconfig switch [In 2008]

How to authenticate with proxy before the test iteration begins

If you encounter *HTTP 407 Proxy authentication required* errors while playing back your web test, you might have to explicitly authenticate to a proxy server first to be able to run your web test. First you have to consider if you really need to go through this proxy server to be able to reach the web server under test. If you cannot get around the proxy server, you can authenticate through code in a WebTestPlugin. You have to use a plugin for this since you cannot set the credentials through the Visual Studio UI.

```
using System;
using Microsoft.VisualStudio.TestTools.WebTesting;
using System.Net;

namespace WebTestPluginNamespace
{
    public class MyWebTestPlugin : WebTestPlugin
    {
        public override void PreWebTest(object sender, PreWebEventArgs e)
        {
            // Create credentials to authenticate to your proxy
            NetworkCredential proxyCredentials = new NetworkCredential();
            proxyCredentials.Domain = "yourDomain";
            proxyCredentials.UserName = "yourUserName";
            proxyCredentials.Password = "yourPassword";

            // Create a WebProxy object for your proxy
            WebProxy webProxy = new WebProxy("<http://yourproxy>");
            webProxy.Credentials = proxyCredentials;

            //Set the WebProxy so that even local addresses use the proxy
            // webProxy.BypassProxyOnLocal = false;

            // Use this WebProxy for the Web test
            e.WebTest.WebProxy = webProxy;

            e.WebTest.PreAuthenticate = true;
        }
    }
}
```

How to enumerate WebTextContext and Unit TestContext objects

Web and Unit TestContext objects contain similar information, but are actually collections of different types of objects. The Microsoft.VisualStudio.TestTools.WebTesting.WebTextContext class is a collection of KeyValuePair<string,object> objects, but the Microsoft.VisualStudio.TestTools.UnitTesting.TestContext class has a property called Properties that is a collection of DictionaryEntry objects. Thus, the collections need to be enumerated in a slightly different way.

```
// Web Test
// using System.Collections.Generic;
// using Microsoft.VisualStudio.TestTools.WebTesting;
public static void DumpArgs(WebTextContext context)
{
    foreach (KeyValuePair<string, object> kvp in context)
    {
        Debug.WriteLine(kvp.Key + " = " + kvp.Value);
    }
}

// Unit Test
// using System.Collections;
// using Microsoft.VisualStudio.TestTools.UnitTesting;
public static void DumpArgs(TestContext context)
{
    foreach (DictionaryEntry kvp in context.Properties)
    {
        Debug.WriteLine(kvp.Key + " = " + kvp.Value );
    }
}
```

How to manually move the data cursor

Add the following line of code to force the parameter database to advance by one row. This is useful if you need to loop through sections of code in a single iteration and want to use different data.

```
this.MoveDataTableCursor("DataSource1", "Products");
```

New to 2010

VS 2010 also allows you to set the cursor to a specific row:

```
this.MoveDataTableCursor("DataSource1", "Products", 32);
```

How to programmatically create a declarative web test

Declarative web tests are non-coded web tests that can be displayed and modified in the web test UI. In Visual Studio 2008 the APIs needed to programmatically create declarative web tests have been exposed. If you want to programmatically generate web tests you can now do this using the DeclarativeWebTest and DeclarativeWebTestSerializer classes.

DeclarativeWebTestSerializer loads the contents of a .webtest file into an instance of the DeclarativeWebTest class and can also save an instance of the DeclarativeWebTest class back out to a .webtest file.

DeclarativeWebTest exposes all of the properties, requests, and rules of the loaded web test so they can be manipulated in whatever way necessary and then resaved.

For example, if something in your web application has changed that affects a large group of your existing Web Tests, rather than modify the tests by hand you could write some code to do this for you. Here's an example of modifying an existing declarative web test in a C# console application:

```
static void Main(string[] args)
{
    DeclarativeWebTest decWebTest
    DeclarativeWebTestSerializer.Open(@"c:\test.webtest");

    //Add a Request to this WebTest
    WebTestRequest newRequest = new
        WebTestRequest("http://newRequest/default.aspx");
    decWebTest.Items.Add(newRequest);

    //Set ExpectedHttpStatus to 404 on the 1st Request
    WebTestRequest reqToModify = null;
    foreach (WebTestItem item in decWebTest.Items)
    {
        if (item is WebTestRequest)
        {
            reqToModify = item as WebTestRequest;
            break;
        }
    }

    if (reqToModify != null)
    {
        reqToModify.ExpectedHttpStatusCode = 404;
    }

    //Save Test
    DeclarativeWebTestSerializer.Save(decWebTest, @"c:\test.webtest");
}
```

How to modify the string body programmatically in a declarative web test

The string body of a web test may be modified programmatically by setting e.Request.Body.BodyString in the request.

```
public class EditBodyString : WebTestRequestPlugin
{
    public override void PreRequest(object sender, PreRequestEventArgs e)
    {
        StringHttpBody body = e.Request.Body as StringHttpBody;
        if (body != null)
        {
            body.BodyString = "blah";
        }
        e.Request.Body = body;
    }
}
```

Gotcha: Check Your Validation Level in the Load Test Run Settings

By default, all validation rules added to a web test are marked HIGH. By default, all load tests have a validation level of LOW. This means that NONE of the validation rules will run in a load test by default. You either need to lower the level in the web test, or raise the level in the load test.

Gotcha: Do not adjust goals too quickly in your code

When you are changing the goals used for the test, or if you are using multiple goals and switching between them, be careful not to change the goal too often. One thing that may not be obvious is that as the user load decreases because of the goal, the number of tests running does not decrease until some tests complete. If your tests take more time than the time used to change the goals you use, it's quite possible the effective user load will never go down when the goal changes and will only go up.

Gotcha: Response body capture limit is set to 1.5 MB by default

The ResponseBodyCaptureLimit property on a web test defaults to 1,500,000 bytes. If you are trying to parse or extract data beyond this size, your test will fail. In order to work around this use a coded web test or a plugin with a declarative web test and set the RequestBodyCaptureLimit property. Here is a sample of a web test plug-in that sets this property in the PreWebTest event.

```
public class MyWebTestPlugin : WebTestPlugin
{
    public override void PreWebTest(object sender, PreWebTestEventArgs e)
    {
        e.WebTest.RequestBodyCaptureLimit = 10 * 1024 * 1024; // 10 MB
    }
}
```

Gotcha: Caching of dependent requests is disabled when playing back Web Tests

Caching for all dependent requests is disabled when you are playing back a web test in Visual Studio. You will notice that if, for example, the same image file is used in multiple web pages in your web test, the image will be fetched multiple times from the web server.

Best Practice: Blog on various considerations for web tests running under load

The following blog entry describes a number of different features and settings to consider when running web tests under a load test in VSTT (a link to the blog entry is at the bottom of this topic). The following topics are covered:

- General Load Test Considerations
 - Verify web tests and unit tests
 - Choose an appropriate load profile
 - Using a Step Load Profile
 - Using a Goal-Based Load Profile
 - Choosing the location of the Load Test Results Store
 - Consider including Timing Details to collect percentile data
 - Consider enabling SQL Tracing
 - Don't Overload the Agent(s)
 - Add an Analysis Comment
- Consideration for Load Tests that contain Web Tests
 - Choose the Appropriate Connection Pool Model
 - ConnectionPerUser
 - ConnectionPool
 - Consider setting response time goals for web test requests
 - Consider setting timeouts for web test requests
 - Choose a value for the "Percentage of New Users" property
 - Consider setting the "ParseDependentRequests" property of your web test requests to false

<http://blogs.msdn.com/billbar/articles/517081.aspx>

Best Practice: Coded web tests and web test plug-ins should not block threads

<http://blogs.msdn.com/billbar/archive/2007/06/13/coded-web-tests-and-web-test-plug-ins-should-not-block-the-thread.aspx>

Best Practice: considerations when creating a dynamic goal based load test plugin:

If there is a chance that the load test will be run on a test rig, be sure to limit the code to running on only one agent machine. Running the code on multiple agents will cause contention in the behavior and will yield unexpected results. You will not receive an error. The following code from a load test plugin Initialize method will force the code to run on only one agent and will work for rigs AND for locally run tests:

```
public void Initialize(LoadTest loadTest)
{
    // ONLY run this on one agent to avoid contention.
    if (loadTest.Context.AgentId == 1)
    {
        LoadTestGoalBasedLoadProfile goalLoadProfile = new LoadTestGoalBasedLoadProfile();

        // Since the heartbeat handler is inside the conditional, The event will be setup
        // only on one machine All LoadProfile changes are sent to the controller and
        // propagated across the rig automatically
        loadTest.Heartbeat += new EventHandler<HeartbeatEventArgs>(_loadTest_Heartbeat);
    }
}
```

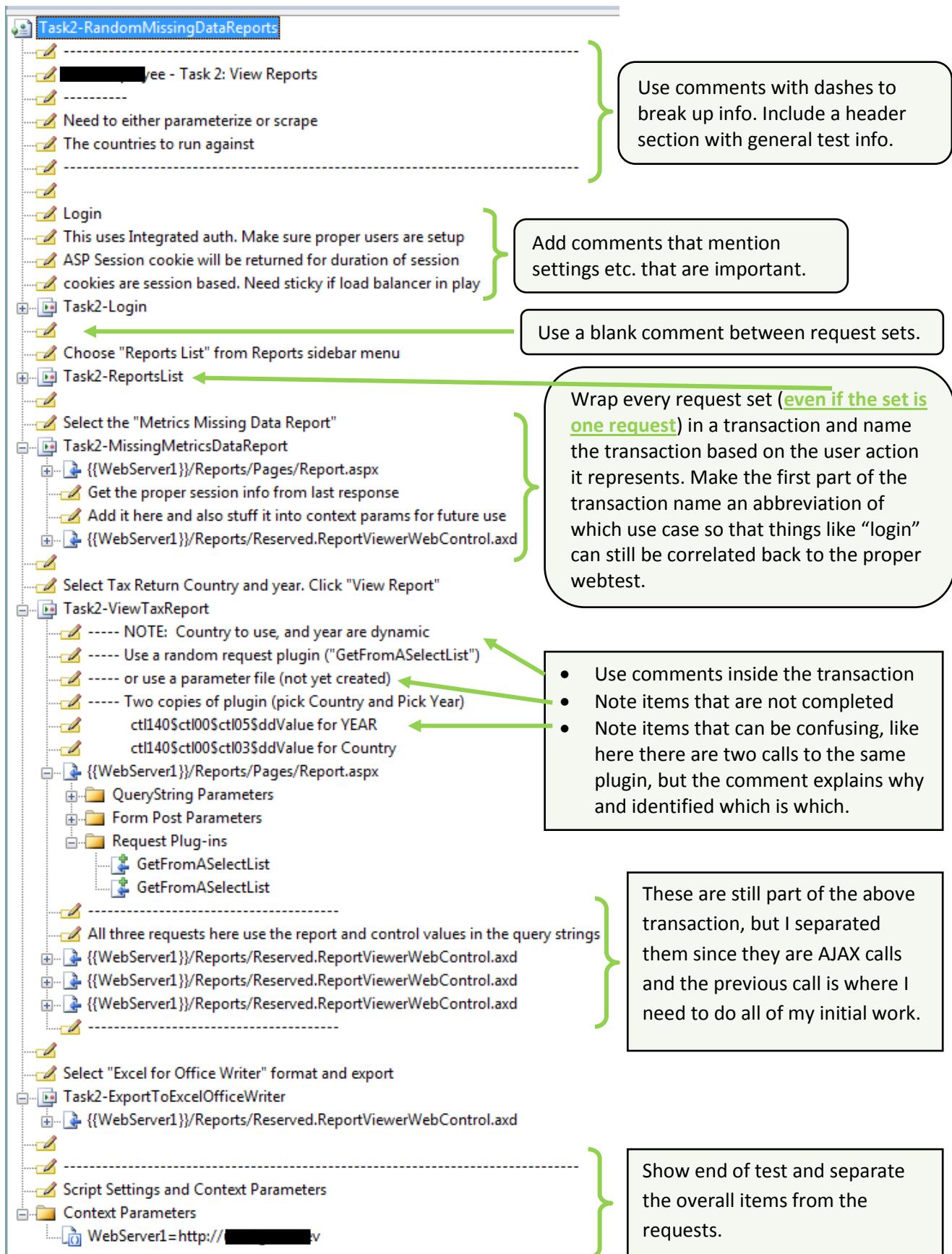
Best Practice: Add an Analysis Comment

After the load test is complete and you have spent some time analyzing the results, you can add a short one line description and an arbitrarily long analysis comment to be stored permanently with the load test result. To do this, in the load test result viewer, right click and choose the “Analysis” option. This brings up a dialog that allows you to enter your analysis text which is stored in the load test results database when you click OK to close the dialog. NOTE: This can be done while the test is running. You do not need to wait for the test to finish.

Any comments and descriptions added will show up in the “Manage Load Test Results” dialog and will make it much easier to determine which result set maps to the test run you wish to look at.

Best Practice – Using comments in declarative webtests

The graphic on the next page shows a sample declarative web test with a bunch of comments that are used to make the web test more readable and to make it easier to correlate results. The comments in the test do NOT affect the performance at all.



Extensibility

New Inner-text and Select-tag rules published on Codeplex

Changed in 2010

In 2008

All of the rules in this release on CodePlex relate to the inner text of a tag. For example, for a select tag (list box and combo box), the option text is stored in inner text rather than an attribute:

```
<select name="myselect1">
<option>Milk </option>
<option>Coffee</option>
<option selected="selected">Tea</option>
</select>
```

In order to extract the value of the list box, we need to parse out the inner text of the selected option. TextArea is another tag that does this, but there are also a lot of other examples in HTML where you might want to extract or validate inner text. The new project has these new rules as well as a parser for inner text and select tag:

1. ExtractionRuleInnerText
2. ExtractionRuleSelectTag
3. ValidationRuleInnerText
4. ValidationRuleSelectTag

Download location

<http://codeplex.com>

In 2010

Many of the features above are now built into VS 2010. Here is a list of these:

[http://msdn.microsoft.com/en-us/library/bb385904\(VS.100\).aspx](http://msdn.microsoft.com/en-us/library/bb385904(VS.100).aspx)

How to Add Custom Tabs to the Playback UI

Another new feature of the 2010 Web Test Playback UI is the ability to add new tabs to the **WebTestResultViewer**. Here is a tab that demonstrates how to get VIEWSTATE data from webtest responses and add that data to a table in a custom results tab:

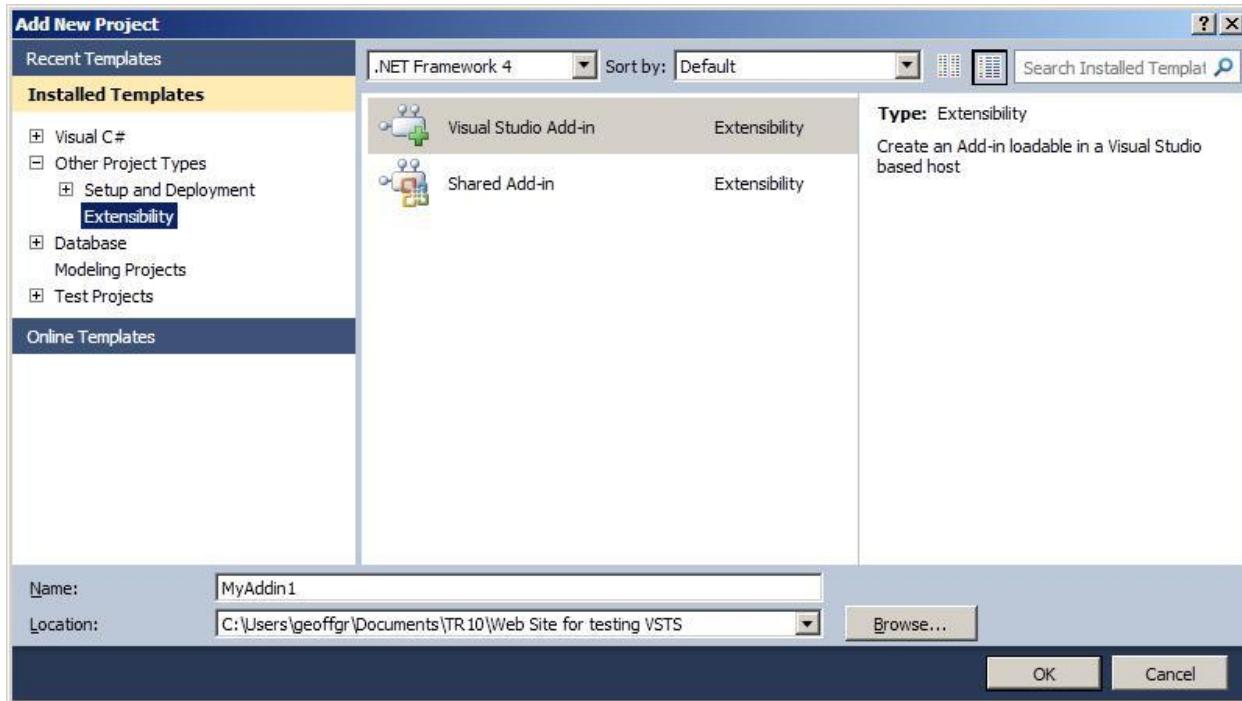
The screenshot shows the Microsoft Visual Studio Performance Testing interface. At the top, there's a toolbar with various icons. Below it is a status bar indicating "MSDN_for_ViewSatae [1:08 PM] X MSDN_for_ViewSatae.webtest". The main area is a grid-based results viewer. The columns are labeled: Request, Status, Total T..., Request..., Reque..., Response The rows show several requests, including logins and MSDN pages, with their respective status codes, times, and response sizes. Below the grid, there's a navigation bar with tabs: Web Browser, Request, Response, Context, Details, and ViewState Info. The ViewState Info tab is currently selected. Underneath this, there's a checkbox labeled "Show pages without Viewstate" which is checked, and a text input field showing "Total ViewState Size (in bytes) 324". At the bottom of the ViewState Info section is a table:

URL	ViewState Size
http://msdn.microsoft.com/	No VIEWSTATE
http://msdn.microsoft.com/en-us/default.aspx	136
http://blogs.msdn.com/edglas/archive/2010/02/16/parameterizing-tests-to-run-in-different-environ...	52
http://msdn.microsoft.com/	No VIEWSTATE
http://msdn.microsoft.com/en-us/default.aspx	136
http://login.live.com/login.srf?wa=wsignin1.0&rpsnv=11&ct=1267121304&rver=6.0.5276.0&wp=...	No VIEWSTATE
http://login.live.com/login.srf?wa=wsignin1.0&rpsnv=11&ct=1266443657&rver=6.0.5276.0&wp=...	No VIEWSTATE
http://login.live.com/pp700/RDHelper_JS.srf?x=7.0.13330.0&l=1033	No VIEWSTATE
https://login.live.com/posecure/post.srf?wa=wsignin1.0&rpsnv=11&ct=1266443657&rver=6.0.52...	No VIEWSTATE

Steps to implement your own custom tab

1) Create the new project

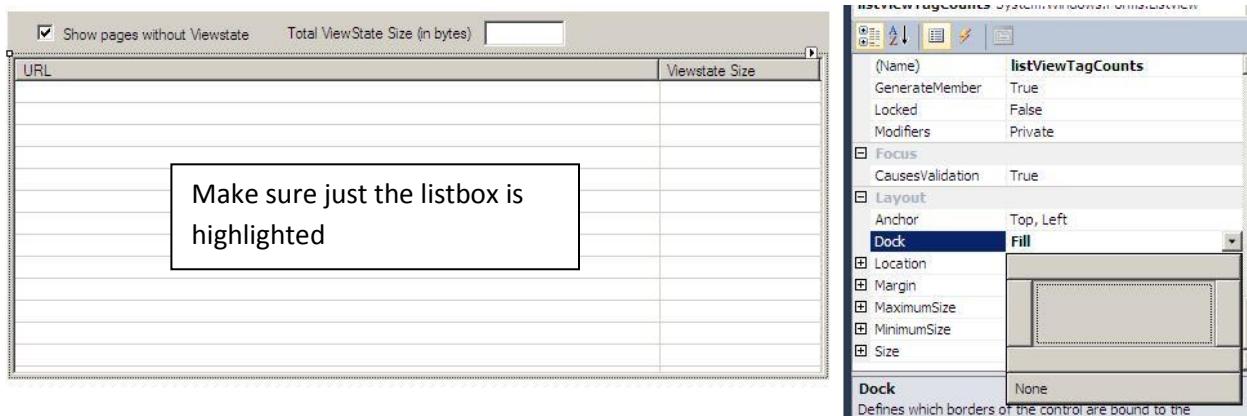
- **Create a Visual Studio Add-In:** Create a new Visual Studio Add-In project (see picture below). This starts the **Add-In Wizard**. Complete the wizard



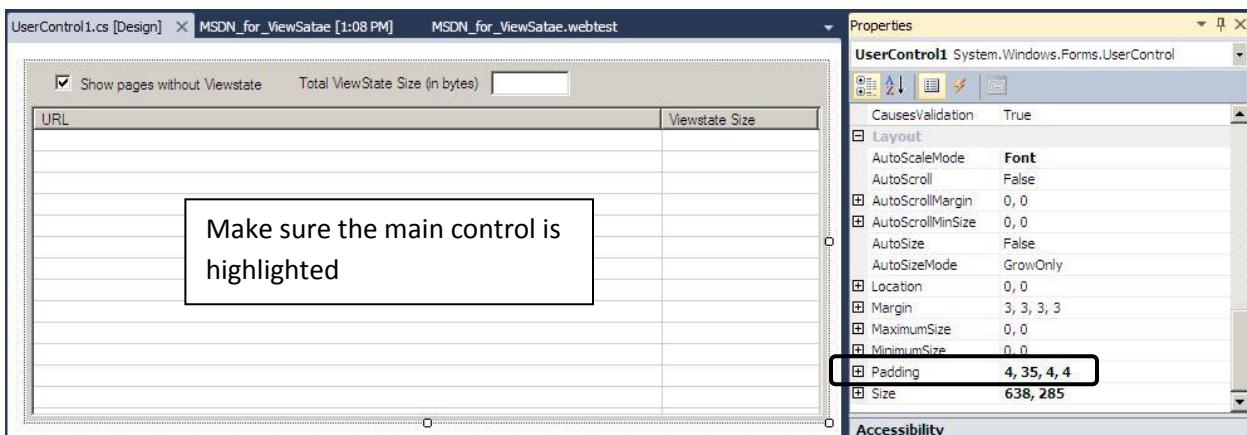
- You should now have a project that looks like:



- **Reference the following assemblies directly in the project:**
 - Microsoft.VisualStudio.QualityTools.LoadTestFramework
 - Microsoft.VisualStudio.QualityTools.WebTestFramework
 - Any other assemblies or code you will need to do the functional work of your addin.
- **Add a user control to the project** (right click -> Add new -> user control). This will house the items to be displayed on the tab.
- **Add the necessary controls to the main user control.** For my example, I needed a checkbox, textbox and a listbox.
- **Set the listbox Dock property to Fill:** Note that when you do this, it will cause the listbox to cover the other controls. We will fix this next.



- **Set the margins for the main control.** This will correct the size of the listbox from the previous step. Make sure the value for TOP is big enough to uncover the other controls.



2) Modify and add the tab control code

You will need to do a fair amount of work inside the “connect.cs” file to make the plugin work. However, you should have your functional code (or at least the shell of it) in place before doing the connect.cs work so the methods you reference will already exist. For my example, the only extra code I need is the backing code for the user control. Double-Click on the listview and add the following methods:

- **sReqName** is the URL of the current request.
- **sSize** is the calculated size of the ViewState.
- **iTotalSize** is the cumulative value.

All of these properties are calculated and set in the connect.cs code. The code here is solely for modifying the values displayed in the tab.

```
public void AddAValueToTheListView(string sReqName, string sSize, int iTotalSize)
{
    tbTotalSize.Text = iTotalSize.ToString();
    tbTotalSize.Update();
    ListViewItem item = new ListViewItem(new string[] { sReqName, sSize });
    listViewTagCounts.Items.Add(item);
}

private void cbShowNonViewState_CheckedChanged(object sender, EventArgs e)
{
    // Add code to handle hiding non viewstate pages
}
```

3) Modify and add the Addin handler code

Now we can jump into the connect.cs code. Here are the main items of interest for us:

```
public class Connect : IDTExtensibility2
{
    Dictionary<Guid, Dictionary<Guid, UserControl>> m_controls = new Dictionary<Guid,
    Dictionary<Guid, UserControl>>();
    LoadTestPackageExt wpe;
    int iViewStateTotalSize = 0;
```

The iViewStateTotalSize is specific to my particular addin. The highlighted lines need to be added to all web test addins.

```
public void OnConnection(object application, ext_ConnectMode connectMode, object
addInInst, ref Array custom)
{
    _applicationObject = (DTE2)application;
    _addInInstance = (AddIn)addInInst;
    wpe =
    _applicationObject.GetObject("Microsoft.VisualStudio.TestTools.LoadTesting.LoadTestPackag
eExt") as LoadTestPackageExt;

    //process open windows
    foreach (WebTestResultViewer p in wpe.WebTestResultViewerExt.ResultWindows)
    {
        WindowCreated(p);
    }
    wpe.WebTestResultViewerExt.WindowCreated += new
    EventHandler<WebTestResultViewerExt.WindowCreatedEventArgs>(wpe_WebtestPlaybackWindowCrea
ted);
    wpe.WebTestResultViewerExt.WindowClosed += new
    EventHandler<WebTestResultViewerExt.WindowClosedEventArgs>(WebTestResultViewerExt_WindowC
losed);
    wpe.WebTestResultViewerExt.SelectionChanged += new
    EventHandler<WebTestResultViewerExt.SelectionChangedEventArgs>(WebTestResultViewerExt_Sel
ectionChanged);
    wpe.WebTestResultViewerExt.TestCompleted += new
    EventHandler<WebTestResultViewerExt.TestCompletedEventArgs>(WebTestResultViewerExt_TestCo
mpleted);
    iViewStateTotalSize = 0;
}
```

This method already exists. Delete everything in the method and add this code.

This line of code is specific to my addin. You should add any initialization code you might need right here.

The highlighted method names correspond to the matching method definitions below.

```

private void WindowCreated(NebTestResultViewer viewer)
{
    UserControl1 c = new UserControl1();
    c.Dock = DockStyle.Fill;
    //add the dictionary of open playback windows
    System.Diagnostics.Debug.Assert(!m_controls.ContainsKey(viewer.TestResultId));
    Dictionary<Guid, UserControl> userControls = new Dictionary<Guid, UserControl>();

    //add the summary
    Guid summaryGuid = Guid.NewGuid();
    Guid responseGuid = Guid.NewGuid();
    userControls.Add(responseGuid, c);
    m_controls.Add(viewer.TestResultId, userControls);

    //add tabs to playback control
    viewer.AddResultPage(responseGuid, "ViewState Info", c);
}

```

This is stock code. Copy all of it and simply change the user control name to whatever name you gave your control in the previous section.

The text here is the name that appears on the added tab

```

void WebTestResultViewerExt_TestCompleted(object sender,
WebTestResultViewerExt.TestCompletedEventArgs e)
{
    foreach (UserControl userControl in m_controls[e.TestResultId].Values)
    {
    }
}

```

This is stock code. No modification is needed.

```

void WebTestResultViewerExt_WindowClosed(object sender,
WebTestResultViewerExt.WindowClosedEventArgs e)
{
    if (m_controls.ContainsKey(e.WebTestResultViewer.TestResultId))
    {
        //process open windows
        foreach (Guid g in m_controls.Keys)
        {
            e.WebTestResultViewer.RemoveResultPage(g);
        }

        m_controls.Remove(e.WebTestResultViewer.TestResultId);
    }
}

```

This is stock code. No modification is needed.

```

void wpe_WebtestPlaybackWindowCreated(object sender,
WebTestResultViewerExt.WindowCreatedEventArgs e)
{
    WindowCreated(e.WebTestResultViewer);
}

```

This is stock code. No modification is needed.

And here is the workhorse method:

This diagram shows a block of C# code with several annotations:

- A vertical bracket on the left side of the code is labeled "This is stock code."
- An annotation box at the top right says "This is the user control you created." with an arrow pointing to the line "UserControl1 userControl1 = userControl as UserControl1;"
- A large curly brace on the right side of the code is labeled "This is code that does the work for the addin. Here I get all of the data and then call my control to populate the tab." with an arrow pointing to the line "userControl1.AddAValueToTheListView(str1, str2, iViewStateTotalSize);"
- A box at the bottom right says "The call to my user control to populate the tab." with an arrow pointing to the same line as the previous annotation.

```
void WebTestResultViewerExt_SelectionChanged(object sender,
WebTestResultViewerExt.SelectionChangedEventArgs e)
{
    if (e.WebTestRequestResult != null)
    {
        foreach (UserControl userControl in m_controls[e.TestResultId].Values)
        {
            UserControl1 userControl1 = userControl as UserControl1;
            if (userControl1 != null)
            {
                WebTestResponse response = e.WebTestRequestResult.Response;

                // Count the number of occurrences of each tag in the response
                Dictionary<string, int> tagCounts = new Dictionary<string,
int>(StringComparer.OrdinalIgnoreCase);
                if (response != null && response.BodyBytes != null)
                {
                    string str1 = response.ResponseUri.ToString();
                    string str2 = "No VIEWSTATE Detected";
                    if (response.BodyString.Contains("_VIEWSTATE"))
                    {
                        //<input type="hidden" name="__VIEWSTATE" id="__VIEWSTATE"
value="/wEPQ...z+aZmiNA==" />
                        int x = response.BodyString.IndexOf("id=\"__VIEWSTATE\""
value=""");
                        int y = response.BodyString.IndexOf("\" />", x);
                        if ((y - x - 24) > 0)
                        {
                            str2 = Convert.ToString(y - x - 24);
                            iViewStateTotalSize = iViewStateTotalSize + (y - x - 24);
                        }
                    }
                    userControl1.AddAValueToTheListView(str1, str2, iViewStateTotalSize);
                }
            }
        }
    }
}
```

Items not specific to the VSTS testing platform

Using the VSTS Application Profiler

Various articles to consider:

<http://blogs.msdn.com/profiler/archive/2008/10/15/walkthroughs-using-vsts-test-and-profilers-to-find-performance-issues.aspx>

<http://msdn.microsoft.com/en-us/magazine/cc337887.aspx?pr=blog>

http://www.codeguru.com/cpp/v-s/devstudio_macros/visualstudionet/article.php/c14823_1/

VSTS 2008 Application Profiler New Features

The VSTS perf team has added some blog posts outlining new features of the VSTS profiler and how to use them. These features include a quick tool to find “hotspots” in your app, and the ability to use performance counters to enhance your profiler diagnosis. See the following links to get this info:

<http://blogs.msdn.com/profiler/archive/2007/10/19/articles-on-new-visual-studio-team-system-2008-profiler-features.aspx>

Using System.NET Tracing to debug Network issues

<http://blogs.msdn.com/dgorti/archive/2005/09/18/471003.aspx>

Logparser tips and tricks

1. Use square brackets around an alias name to allow spaces in the names. Example: [User Data]
2. If you need to get a substring but also need to delete characters at the end of the substring, you can use an abbreviated syntax:

Substr(mystring, 1, sub(strlen(mystring),19)) **can be written as** Substr(mystring,1,-19)

Logparser WEB Queries

Count (and percentage) of status codes from Web Logs

```
-i:IISW3C -recurse:-1 -Q:on "SELECT sc-status, COUNT(*), MUL(POPCOUNT(*),100.0) AS Percentage INTO StatusCount.txt FROM ex*.log GROUP BY sc-status ORDER BY sc-status"
```

Breakdown of web status codes by pagetype from Web Logs

```
-i:IISW3C -recurse:-1 -Q:on "SELECT EXTRACT_EXTENSION(TO_UPPERCASE(cs-uri-stem)) AS PageType, sc-status, COUNT(*) AS Amount INTO StatusCodes.txt FROM ex*.log GROUP BY sc-status, PageType ORDER BY sc-status ASC" -o:TSV
```

Number of hits by pagetype

```
-i:IISW3C -recurse:-1 -Q:on "SELECT EXTRACT_EXTENSION(TO_UPPERCASE(cs-uri-stem)) AS PageType, COUNT(*) AS Amount INTO pagetype.txt FROM ex*.log GROUP BY PageType ORDER BY Amount DESC" -o:TSV
```

List of requests asking for non existant pages

```
-i:IISW3C -recurse:-1 -Q:on "SELECT DISTINCT cs-uri-stem AS Url USING sc-status AS statuscode INTO not-found.txt FROM ex*.log WHERE statuscode = 404" -o:TSV
```

Top 10 slowest page responses

```
-i:IISW3C -recurse:-1 -Q:on "SELECT TOP 10 MAX(time-taken) AS Processing-Time, AVG(time-taken) AS Average, MIN(time-taken) AS Minimum, cs-uri-stem AS Url, COUNT(cs-uri-stem) AS PageCount INTO longrunning.txt FROM ex*.log GROUP BY cs-uri-stem ORDER BY Average DESC" -o:TSV
```

Average Max and Min time taken for each page type

```
-i:IISW3C -recurse:-1 -Q:on "SELECT EXTRACT_EXTENSION(cs-uri-stem) as Type, AVG(time-taken) AS Average, MAX(time-taken) AS Maximum, MIN(time-taken) AS Minimum INTO PageTimes.txt FROM ex*.log WHERE time-taken > 0 GROUP BY Type ORDER BY Average DESC"
```

Requests and Total Bytes per hour

```
-i:IISW3C -recurse:-1 -Q:on "SELECT QUANTIZE(TO_TIMESTAMP(date, time), 3600) AS Hour, COUNT(*) AS Total, SUM(sc-bytes) AS TotBytesSent INTO HitsByHour.txt FROM ex*.log GROUP BY Hour ORDER BY Hour" -o:TSV
```

List and count of pages returning a status code of 500

```
-i:IISW3C -recurse:-1 -Q:on "SELECT cs-uri-stem, sc-status, COUNT(*) FROM ex*.log WHERE sc-status=500 GROUP BY cs-uri-stem, sc-status ORDER BY cs-uri-stem" -o:TSV
```

LogParser Non-Web Queries

Parsing Event Viewer files on Vista with LogParser

You need to convert the files to Vista format. The following command line will do this:

```
wEvtutil epl app.evtx app.evt /lf:true
```

Query For Text Strings in a file

```
-i:TEXTLINE "SELECT LTRIM(extract_token(text, 1,'Text to find')) as string FROM *.txt  
WHERE string is not null"
```

Pulling data from inside the body string of event viewer logs

```
logparser -i:evt "SELECT extract_prefix(extract_suffix(Strings,0,'left text'),0,'right  
text') as String INTO optimizer.txt FROM *.EVT WHERE Strings LIKE '%Optimizer  
Results%' -q:ON
```

(variation) Pulling data from inside the body string of event viewer logs constrained by timeframe

```
logparser -i:evt -q:ON "SELECT Count(*) AS Qty, SUBSTR(extract_suffix(Message, 0,  
'Message :'), 0, 75) as String FROM Error! Hyperlink reference not  
valid.name>\Application WHERE SourceName LIKE '%Enterprise%' AND Message LIKE  
'%Timestamp: %' AND TimeGenerated > TIMESTAMP ('2008-06-06 07:23:15', 'yyyy-MM-dd  
hh:mm:ss') GROUP BY String ORDER BY Qty DESC"
```

List of exceptions from saved event logs searching for keywords in the text output

```
-I:evt "SELECT QUANTIZE(TimeGenerated, 3600) AS Hour, COUNT(*) As Total, ComputerName  
FROM *.evt WHERE EventID = 100 AND strings like '%overflow%' GROUP BY ComputerName,  
hour"
```

Logparser command for querying netstat

```
netstat.exe -anp TCP | LogParser "SELECT [Local Address] AS Server, [Foreign Address]  
AS Client,State FROM STDIN WHERE Server LIKE '%:443' OR Server LIKE '%:80'" -i:TSV -  
iSeparator:space -nSep:2 -fixedSep:OFF -nSkipLines:3 -o:TSV -headers:ON
```

Command to query Active Directory®

```
Logparser -i:ADS "SELECT * FROM 'LDAP://Redmond/CN=Microsoft.com FTE,OU=Distribution  
Lists,DC=redmond,DC=corp,DC=microsoft,DC=com'" -objClass:user
```

Command to query IIS and get site configuration information

```
Logparser "select * from IIS://localhost"
```

Command to query Netmon file and list out data on each TCP conversation

```
LogParser -fMode:TCPConn -rtp:-1 "SELECT DateTime, TO_INT(TimeTaken) AS Time,  
DstPayloadBytes, SUBSTR(DstPayload, 0, 128) AS Start_Of_Payload INTO IE-Take2.txt FROM  
IE-Take2.cap WHERE DstPort=80 ORDER BY DateTime ASC" -headers:ON
```

Command to query Netmon and find frame numbers based on specific text in payload

```
LogParser -fMode:TCPIP -rtp:-1 "SELECT Frame, Payload INTO 3dvia.txt FROM 3dvia.cap  
WHERE DstPort=80 AND Payload LIKE '%ppContent%' " -headers:ON
```

Command to get logged start time of an entry in custom log files

```
LogParser -i:TEXTLINE " SELECT TOP 1 TO_TIME(TO_TIMESTAMP(EXTRACT_PREFIX(Text,2,' ')),  
'M/dd/yyyy h:mm:ss tt')) AS [Start Time], 'FirstStartTime' FROM *.log WHERE Text LIKE  
'%text tag to search for%' ORDER BY [Start Time] ASC
```

Older articles

Content-Length header not available in Web Request Object

Currently the web request header “Content-Length” is not in the WebTestRequest object. This is expected to be changed in SP1

SharePoint file upload test may post the file twice

If you have a web test that posts a file to a SharePoint site, the test may try to post the file twice. SharePoint will only process one copy, but the request time and upload size will be incorrect due to the double attempt. This occurs if you are using integrated authentication. The client requests a POST expecting a 100-continue response. It gets a 404 instead (this is expected behavior). However, instead of VSTS restarting the request with credentials, it continues posting the initial request (which SharePoint ignores). When the initial request is done, VSTS will re-post with credentials, and this post will succeed. A fix is available in SP1.

Some Hidden Fields are not parameterized within AJAX calls

When recording web tests with AJAX panel updates, you may find some FORM POST parameters where HIDDEN values (such as VIEWSTATE) are not parameterized. From an email thread:

The problem is that in the Microsoft-Ajax partial rendering (update panel) responses, hidden fields can appear in two places: a field that is marked by the type “|hiddenField|” (where we were looking), but also in a regular hidden field input tag in the HTML within an “|updatePanel|” field in the Ajax response (which we were not looking at).

A fix is being worked on and may appear in SP1. In the meantime, to work around the issue, simply remove the hard-coded value and replace it with a parameterized value: `{{$HIDDEN0.__VIEWSTATE}}` (where the bucket (0,1,2, etc matches the bucket of the other HIDDEN parameters in the request)

(FIX) Unit Test threading models and changing them

The default threading model for unit tests is STA. The fix in SP1 was to have load tests honor this setting (unit test in a load test would not honor the ApartmentState property). See the following blog for more info:

<http://blogs.msdn.com/irenak/archive/2008/02/22/sysk-365-how-to-get-your-unit-tests-test-project-in-visual-studio-2008-a-k-a-mstest>

Bug in VSTS 2008 SP1 causes think time for redirected requests to be ignored in a load test

When a web test is run in a load test, any test requests that result in redirects suffer from a timing bug. Any think time that is specified on the request is ignored. This is fixed in a POST-SP1 hotfix:

KB 956397 (<http://support.microsoft.com/kb/956397/en-us>)

<http://blogs.msdn.com/billbar/archive/2008/08/04/bug-in-vsts-2008-sp1-causes-think-time-for-redirected-requests-to-be-ignored-in-a-load-test.aspx>

New Load Test Plugin Enhancements in VSTS 2008 SP1

<http://blogs.msdn.com/billbar/pages/load-test-api-enhancements-in-vsts-2008-sp1-beta.aspx>

Four New Methods added to the WebTestPlugin Class for 2008 SP1

<http://blogs.msdn.com/billbar/pages/web-test-api-enhancements-available-in-vsts-2008-sp1-beta.aspx>

Index

.NET Garbage Collection, 5, 53

A

AJAX, 8, 21, 90, 149

ANSI, 80

Application Domain, 12, 117

authentication, 6, 9, 94, 109, 110, 131, 149

C

Caching, 4, 5, 7, 15, 19, 59, 60, 69, 113, 135

caspol, 84

CodePlex, 3, 138

context, 7, 10, 11, 21, 30, 48, 78, 80, 87, 112, 113, 114, 115, 117, 119, 120, 121, 123, 124, 125, 132, 136

correlation, 21

CSV Files, 6, 80

D

Data Collectors, 78

data source, 4, 5, 6, 7, 14, 67, 70, 80, 113

declarative web test, 6, 7, 9, 48, 49, 79, 81, 85, 111, 112, 114, 125, 133, 134, 136

dependent requests, 6, 7, 11, 19, 66, 77, 78, 90, 111, 113, 116, 135

Deployment, 5, 51, 59, 60, 61, 130

E

Execution Interleaving, 23

extract, 4, 6, 10, 21, 22, 30, 87, 112, 121, 134, 138, 148

F

Fiddler, 4, 50, 79

H

HIDDEN parameters, 8, 87, 112, 149

HTTP Headers, 4, 9, 27, 66, 78, 93, 113, 148

Content-Type, 9

If-Modified-Since, 7, 113

Pragma, 9

Referrer, 9

SOAPAction, 9

x-microsoftajax, 9

I

Internet Explorer, 19, 50, 93, 113

IP Address, 5, 54

L

Licensing, 4, 40, 85

Load Test Options

Agents to Use, 47

Delay Start Time, 47

Disable During Warmup, 47

Logging, 6, 85, 90, 93, 95

lusrmgr.msc, 26

M

MSTest, 13, 23, 78, 100, 101, 105, 107, 149

N

Network

Firewall, 100, 101, 103, 107, 108

Netmon, 79, 148

Netstat, 86, 148

TCP Parameters, 86

TCPView, 129

Tracing, 5, 8, 72, 103, 105, 106, 135, 146

JUnit, 23

P

Parameter Data

Data Source, 4, 5, 6, 14, 67, 70, 80

Random, 4, 7, 14, 99, 100, 114

Sequential, 4, 14, 44

Unique, 4, 14, 54, 66, 74, 78, 98, 114, 120

Parameters, 7, 11, 22, 28, 30, 46, 58, 80, 86, 87, 96, 111, 113, 114, 117, 119, 120, 121, 123, 124, 125, 132, 149

performance counters, 5, 17, 62, 64, 65, 66, 72, 82, 146

Performance Monitor, 5, 65, 66

Permissions, 100, 101

phishing, 81

processor, 6, 17, 42, 63, 64, 85

proxy server, 4, 7, 50, 131

R

random, 4, 7, 14, 99, 100, 114
redirection, 7, 123
regedit, 9, 59
REGISTRY Settings
 HKEY_CURRENT_USER, 9, 93, 106
 HKEY_LOCAL_MACHINE, 59, 81, 86, 107
Reporting Name, 4, 11, 31, 32, 80
RequestHeadersToRecord, 9
Results
 WebTestResult, 6, 76, 77, 78

S

SOAP, 112
SSL
 Certificates, 7, 112, 122
 HTTPS, 6, 81, 83
ServicePointManager, 7, 122
 SecurityProtocol, 122
 SecurityProtocolType, 122
ServicePointManager.
 ServerCertificateValidationCallback, 122
SSLv3, 7, 122
TLS, 7, 122
X509Certificate, 112, 122
Symbols, 59, 60
Sysinternals
 PsTools, 129
 Sysinternals, 106

T

TeamTestAgentService, 26, 100, 103
test rig, 4, 5, 17, 25, 26, 40, 52, 55, 57, 58, 59, 81, 85, 94,
 102, 104, 117, 136
TIME_WAIT, 86
timeouts, 4, 5, 13, 51, 61, 64, 88, 109, 135
Transactions, 6, 36, 37, 68, 71, 72, 73, 74, 82

U

Unicode, 6, 80
URL, 31, 46, 74, 84, 112, 123, 124, 125

V

validate, 5, 6, 7, 10, 11, 58, 94, 96, 115, 122, 123, 125, 134,
 138
verbose logging, 95, 97, 98
VIEWSTATE, 21, 58, 78, 96, 139, 142, 144, 145, 149

Virtual User Pack, 40, 41, 42, 43

VSTT 2010
 branching, 125
 conditional rule, 125, 126
 looping, 14, 125
VSTT Classes
 FormPostHttpBody, 111
 IHttpBody, 111
 StringHttpBody, 111, 134
 WebTest, 45, 50, 115, 120, 121, 122, 123, 124, 131,
 133, 134
 WebProxy, 50, 131
 WebTestContext, 115, 120, 132
 WebTestPlugin, 8, 9, 113, 116, 120, 131, 134, 150
 WebTestRequest, 12, 19, 66, 112, 113, 115, 116, 123,
 133, 149
 ClientCertificates, 112
 WebTestResponse, 115, 145
VSTT Configuration Files
 Counterset files
 DefaultCounter, 65
 DefaultCountersForAutomaticGraphs, 65
 HigherIsBetter, 63
 LoadTestCounterCategoryExistsTimeout, 64
 LoadTestCounterCategoryReadTimeout, 64
 Range, 63
 RangeGroup, 63
 QTAgent.exe.config, 53, 92, 95, 98
 QTAgentService.exe.config, 50, 97
 QTAgentServiceUI.exe.config, 95
 QTController.exe.config, 52, 64, 95
 Test Run Configuration files, 61
 Test Setting files, 61
 VSTestHost.exe.config, 52, 53, 64
 vstst.xsd, 51

VSTT Extraction Rules

 ExtractionRuleInnerText, 138
 ExtractionRuleSelectTag, 138

VSTT Methods

 Add Call to Web Test, 45
 adding a context parameter, 113, 115
 ClassCleanUp, 23, 24
 ClassInitialize, 23, 24, 67
 GetRequestEnumerator, 115, 122
 PostRequest, 10, 113, 115, 116
 PostRequestEvent, 122
 StringHttpBody, 111, 134
 System.Net.HttpWebRequest, 83
 TestCleanUp, 24
 TestInitialize, 23, 24
 WebTestExecutionInstruction, 123, 124

VSTT Plugins	Percentage of New Users, 15, 19, 135
LoadTestAborted, 11	ResponseBodyCaptureLimit, 12, 79, 134
LoadTestFinished, 11	Run unit tests in application domain, 4, 12
LoadTestStarting, 11	Sample Rate, 17, 65
LoadTestWarmupComplete, 11	Statistics Only, 71
PostPage, 10	Stop Adjusting User Count When Goal Achieved, 17
PostRequest, 10, 113, 115, 116	Target Range for Performance Counter, 17
PostTransaction, 10	Test Iterations, 4, 6, 12, 13, 15, 18, 87, 88
PostWebTest, 10, 115, 120	Think Time, 4, 6, 7, 8, 11, 13, 18, 36, 73, 80, 114, 119, 150
PrePage, 9, 10	TimingDetailsStorage, 5, 33, 36, 71, 85, 129, 135
PreRequest, 7, 10, 121, 122, 123, 124, 134	Use Test Iterations, 12
PreTransaction, 9, 10	WebTestIteration, 120
PreWebTest, 9, 10, 131, 134	
TestFinished, 11	VSTT Runtime
TestSelected, 11	QTAgent, 53, 87, 92, 95, 98
TestStarting, 11	QTController, 52, 59, 64, 95, 109
ThresholdExceeded, 11	VSTestHost, 52, 53, 64, 88
VSTT Properties	VSTT Settings
All Individual Details, 33, 71, 85	Administer Test Controllers, 26, 47, 58, 104
Cache Control, 19	Analysis Comment, 7, 135, 136
EventTarget, 121	Follow Redirects, 112
Follow Redirects, 112	VSTT Test Types
Goal Based Load Pattern, 17, 82	Sequential Test Mix, 4, 44
Initial User Count, 17	Web Test Composition, 45
LoadTestMaxErrorsPerType, 52	VSTT Validation Rules
Lower Values Imply Higher Resource Use, 17	ValidationRuleInnerText, 138
MaximumUserCount, 17	ValidationRuleSelectTag, 138