



Visual Studio
ALM Days 2012



Load Testing mit Visual Studio 2012

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Übersicht

Gründe und Zeitpunkt

Einzeltests erstellen

Einzeltests in Lasttests verwenden

Windows Azure zur Lasterzeugung

Gründe

- (Fast) keine Anwendung skaliert linear
- Hohe Benutzeranzahl schlechtere Antwortzeiten



Architekturanforderungen prüfen

PERFORMANCE

Maximum
3 seconds
average page
response
time

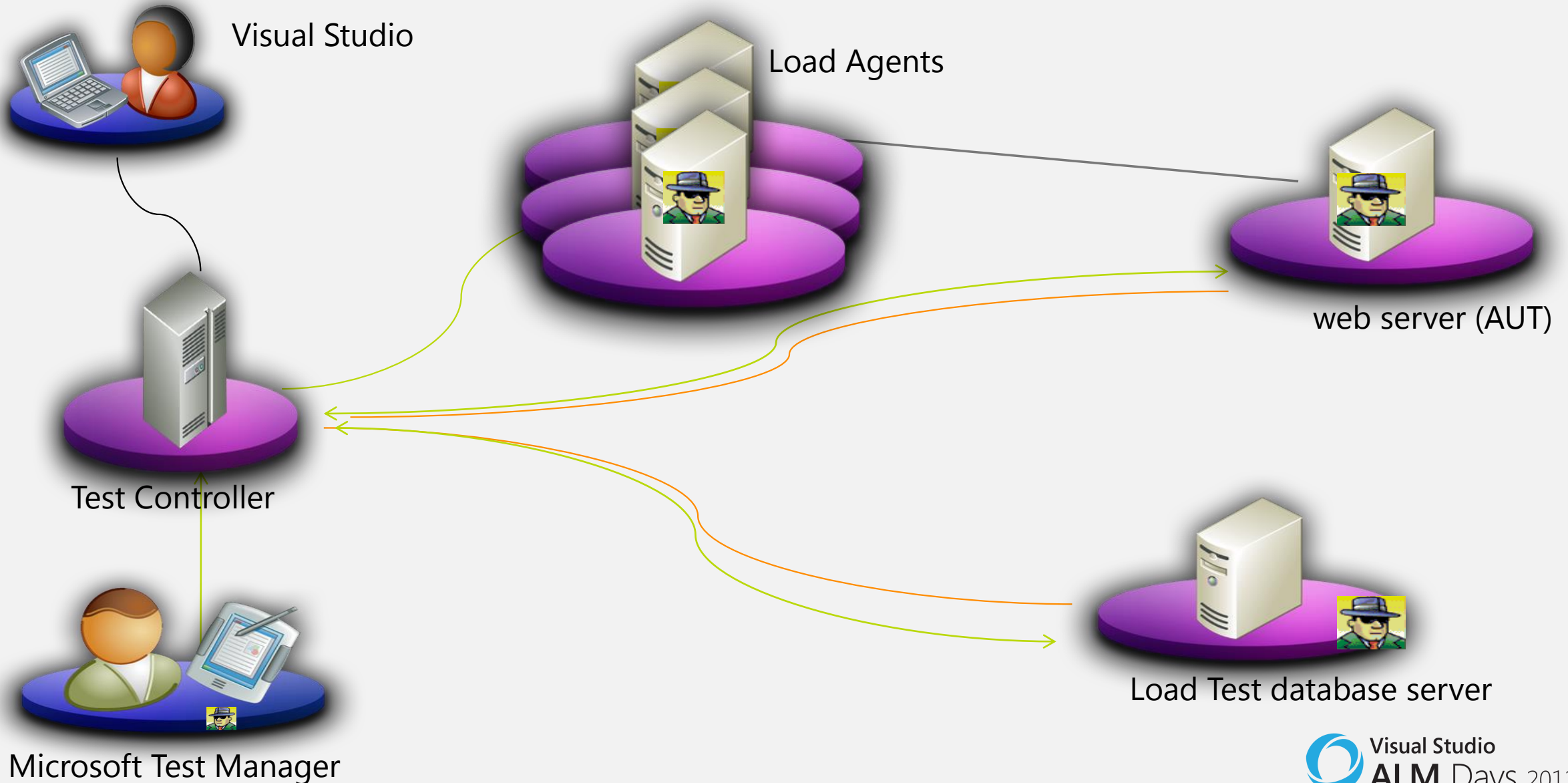
Minimum
25 orders per
seconds

Minimum
1200
concurrent
users with no
timeouts

1 new front
end server
adds 20%
more users

- Zeitpunkt:
- Möglichst früh und regelmäßig
- Einfach beginnen und mitwachsen lassen

Visual Studio 2012 Lasttest Architektur



Einzeltests

WebTests

CodedUITests

Unittests

Datenbanktests

WebTest-Erstellung

The screenshot displays the 'Web Test Recorder' window. The left pane shows a tree view of the recorded test session, including the root URL 'http://www.fabrikam.com/' and several requests to 'http://www.fabrikam.com/ServiceTickets/GetServiceTicket' with 'QueryString Parameters' containing 'ticketId' values 1, 2, 4, and 5. The right pane shows the 'Fabrikam Fiber Support' page content, including a 'Scheduled Maintenance' banner and a 'My Tickets' list. The 'My Tickets' list contains five items, with the second item '[A014102] - Internet Upload spee...' marked with a green checkmark. The right pane also shows '[Assigned] Viewing Recorded Programs' with 'Created On: 3/31/2012 2:21 AM' and 'Assigned To: Brian Keller'.

Web Test Recorder

Record Pause Stop

http://www.fabrikam.com/
http://www.fabrikam.com/ServiceTickets/GetServiceTicket
QueryString Parameters
ticketId=1
http://www.fabrikam.com/favicon.ico
http://www.fabrikam.com/ServiceTickets/GetServiceTicket
QueryString Parameters
ticketId=2
http://www.fabrikam.com/ServiceTickets/GetServiceTicket
QueryString Parameters
ticketId=4
http://www.fabrikam.com/ServiceTickets/GetServiceTicket
QueryString Parameters
ticketId=5

Fabrikam Fiber Support

Scheduled Maintenance: Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

My Tickets

- [A014101] - Modem keeps resetti...
- [A014102] - Internet Upload spee...
- [A014103] - FabFiber is the worst...
- [A014104] - changing channel by...
- [A014105] - Viewing Recorded Pr...

[Assigned] Viewing Recorded Programs

Created On:
3/31/2012 2:21 AM

Assigned To:
Brian Keller

WebTest-Ausführung

The screenshot shows the Visual Studio WebTest execution interface. At the top, there's a toolbar with icons for running tests. Below it, a status bar indicates a 'Failed' test run. The main table displays the results of the test run, including the request URL, status, total time, request time, and response size. The first row shows a successful request to 'http://www.fabrikam.com/' with a status of '200 OK', a total time of 0.060 sec, and a response size of 109,350 bytes. The second row shows a failed request to 'http://www.fabrikam.com/ServiceTickets/GetServiceTicket' with a status of '404 Not Found'. The third row shows a failed request to 'http://www.fabrikam.com/favicon.ico' with a status of '404 Not Found'. The bottom section shows a web browser view of the 'Fabrikam Fiber Support' page, which includes a 'Scheduled Maintenance' message and a 'My Tickets' list. A red error message is displayed in the browser: 'There was an error while retrieving data from the server'.

Request	Status	Total Time	Request Time	Request ...	Response By...
http://www.fabrikam.com/	200 OK	0.060 sec	0.023 sec	0	109,350
http://www.fabrikam.com/ServiceTickets/GetServiceTicket	200 OK	0.008 sec	0.008 sec	0	268
http://www.fabrikam.com/favicon.ico	404 Not Found	0.002 sec	0.002 sec	0	3,056
http://www.fabrikam.com/ServiceTickets/GetServiceTicket	200 OK	0.008 sec	0.008 sec	0	273
http://www.fabrikam.com/ServiceTickets/GetServiceTicket	200 OK	0.007 sec	0.007 sec	0	268
http://www.fabrikam.com/ServiceTickets/GetServiceTicket	200 OK	0.008 sec	0.008 sec	0	269

Web Browser | Request | Response | Context | Details

Fabrikam Fiber Support

Scheduled Maintenance: Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolo

My Tickets

- [A014101] - Modem keeps resett...
- [A014102] - Internet Upload spee... ✓
- [A014103] - FabFiber is the worst... ✗
- [A014104] - changing channel by...

There was an error while retrieving data from the server

Dauert ein Aufruf besonders lang?

Werden viele Daten übertragen?

Treten Fehler auf?

Think Time und Response Time Goal

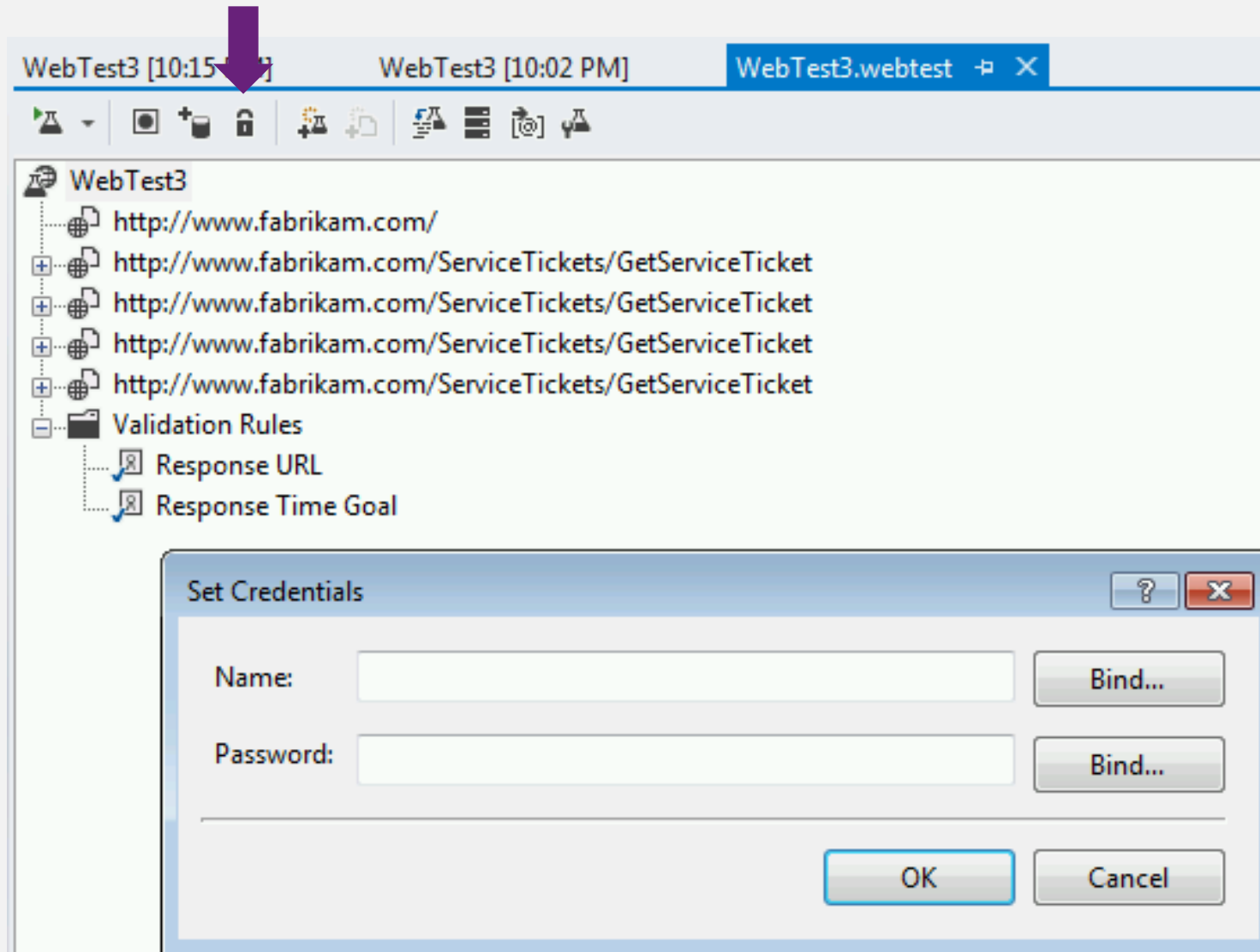
Request Details

Configure individual request properties

Request	Reporting Name	Think Time	Response Time Goal
http://www.fabrikam.com/		0	
http://www.fabrikam.com/ServiceTickets/GetServiceTicket		0	
http://www.fabrikam.com/ServiceTickets/GetServiceTicket		4	
http://www.fabrikam.com/ServiceTickets/GetServiceTicket		1	
http://www.fabrikam.com/ServiceTickets/GetServiceTicket		0	

OK Cancel

Credentials



Caching

Properties Microsoft.VisualStudio.TestTools.WebStress

Cache Control	False
Encoding	utf-8
Expected HTTP Status Code	0

Cache Control
True indicates that the requests are cached.
False indicates that the requests are not cac...

Datengetrieben

New Test Data Source Wizard

Select the type of data source

Data source name
DataSource1

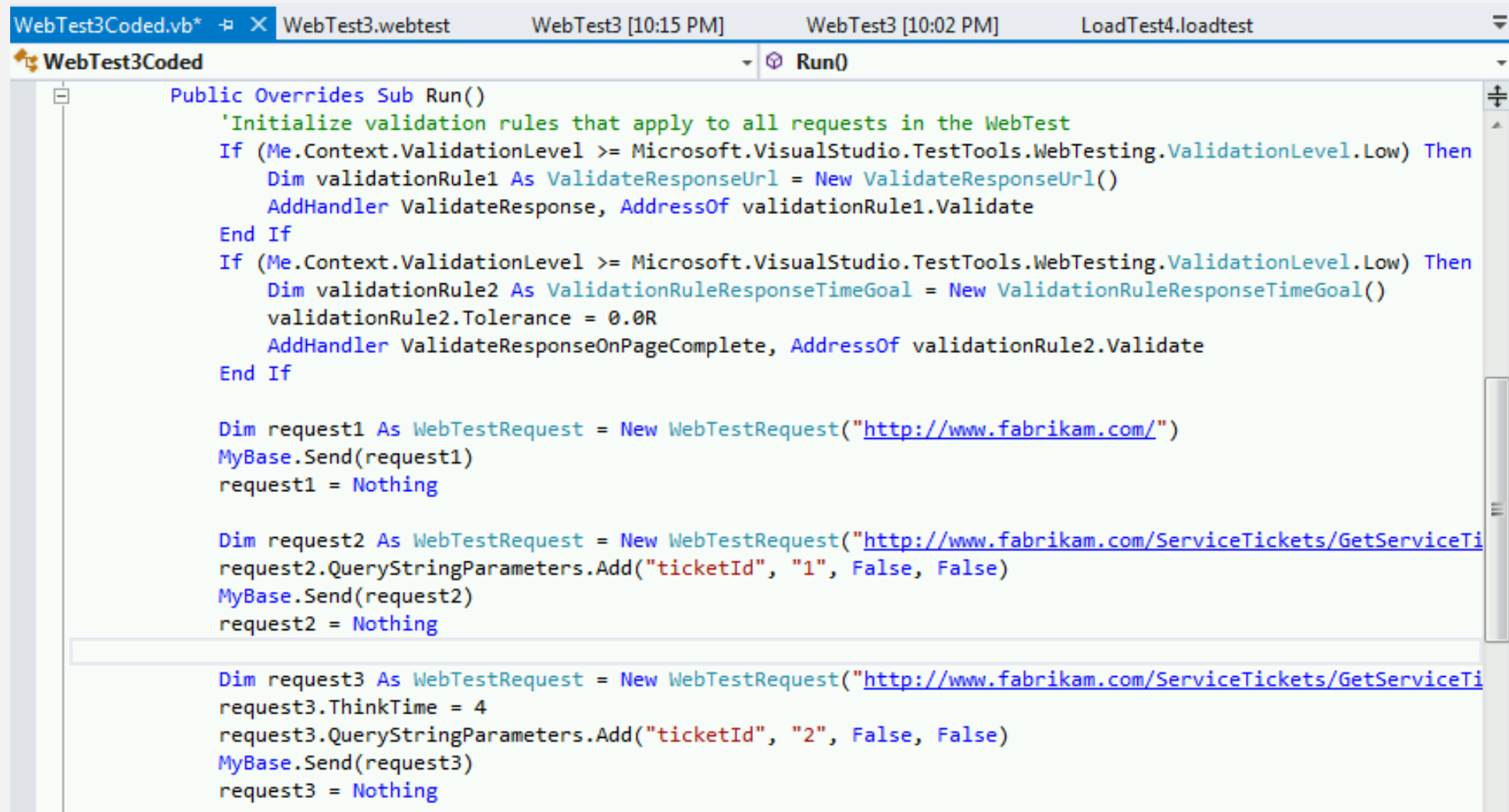
Data source type

Database CSV File XML File

Please select the type of data that will be the basis for this data source

< Previous Next > Finish Cancel

Quellcode



```
WebTest3Coded.vb*  WebTest3.webtest  WebTest3 [10:15 PM]  WebTest3 [10:02 PM]  LoadTest4.loadtest
WebTest3Coded  Run()

Public Overrides Sub Run()
    'Initialize validation rules that apply to all requests in the WebTest
    If (Me.Context.ValidationLevel >= Microsoft.VisualStudio.TestTools.WebTesting.ValidationLevel.Low) Then
        Dim validationRule1 As ValidateResponseUrl = New ValidateResponseUrl()
        AddHandler ValidateResponse, AddressOf validationRule1.Validate
    End If
    If (Me.Context.ValidationLevel >= Microsoft.VisualStudio.TestTools.WebTesting.ValidationLevel.Low) Then
        Dim validationRule2 As ValidationRuleResponseTimeGoal = New ValidationRuleResponseTimeGoal()
        validationRule2.Tolerance = 0.0R
        AddHandler ValidateResponseOnPageComplete, AddressOf validationRule2.Validate
    End If

    Dim request1 As WebTestRequest = New WebTestRequest("http://www.fabrikam.com/")
    MyBase.Send(request1)
    request1 = Nothing

    Dim request2 As WebTestRequest = New WebTestRequest("http://www.fabrikam.com/ServiceTickets/GetServiceTi
    request2.QueryStringParameters.Add("ticketId", "1", False, False)
    MyBase.Send(request2)
    request2 = Nothing

    Dim request3 As WebTestRequest = New WebTestRequest("http://www.fabrikam.com/ServiceTickets/GetServiceTi
    request3.ThinkTime = 4
    request3.QueryStringParameters.Add("ticketId", "2", False, False)
    MyBase.Send(request3)
    request3 = Nothing
```

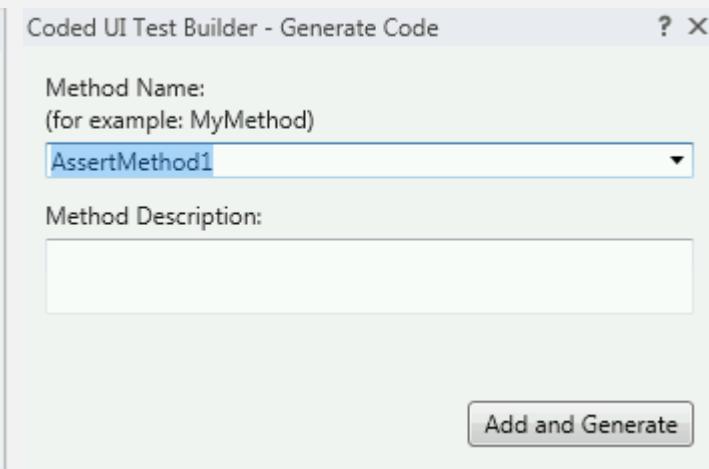
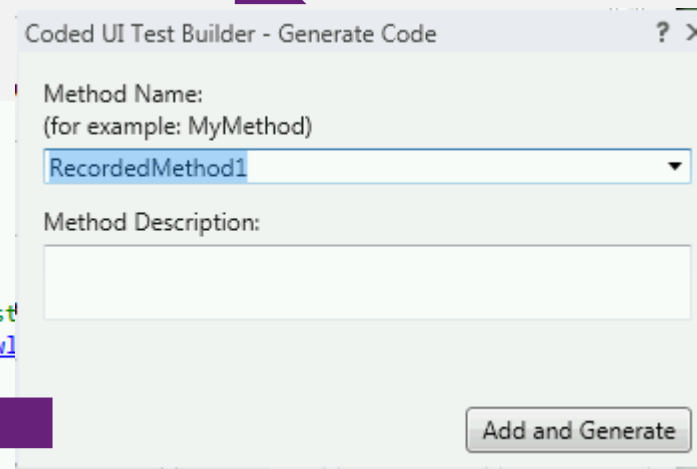
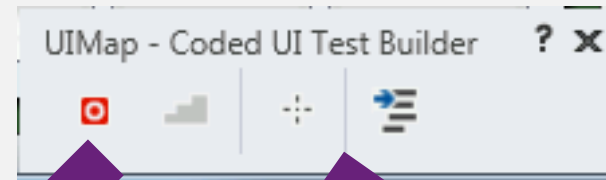
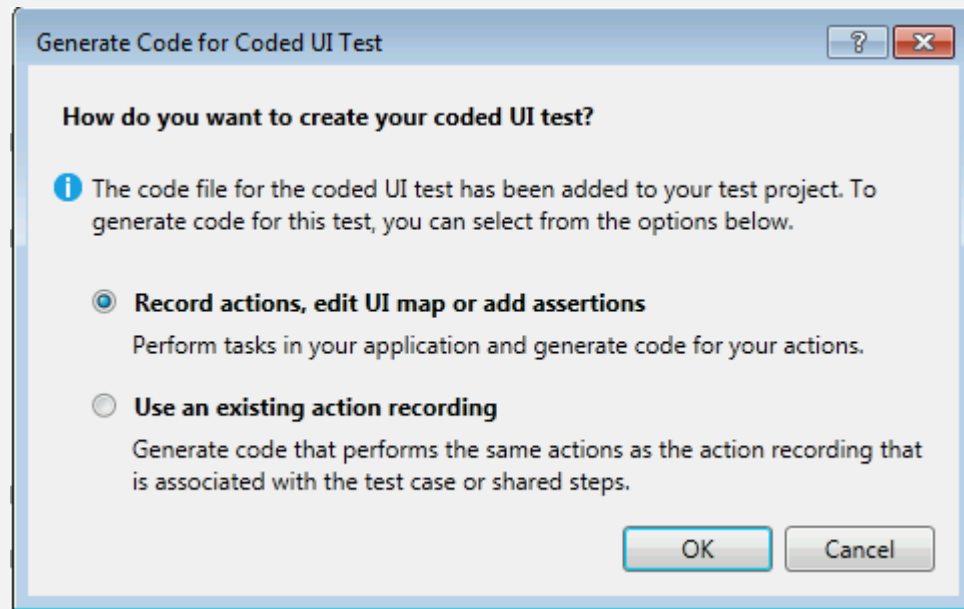
WebTest

Demo

Neu, ausführen und datengetrieben

CodedUITest

- Aufzeichnung und Abspielen von Benutzerinteraktionen



```
<CodedUITest()>
Public Class CodedUITest1

    <TestMethod()>
    Public Sub CodedUITestMethod1()
        ' To generate code for this test, select "Generate Code for Coded UI Test"
        ' For more information on generated code, see http://go.microsoft.com/fwlink
        Me.UIMap.RecordedMethod1()
        Me.UIMap.AssertMethod1()
    End Sub
End Class
```

CodedUITest Demo




Unittests



```
[TestClass()]
public class CustomersControllerTest
{
    MockCustomerRepository mockCustomerRepo;
    CustomersController controller;

    [TestInitialize()]
    public void SetupController()
    {
        mockCustomerRepo = new MockCustomerRepository();
        controller = new CustomersController(mockCustomerRepo);
    }

    [TestMethod()]
    public void CreateInsertsCustomerAndSaves()
    {
        controller.Create(new Customer());

        Assert.IsTrue(mockCustomerRepo.IsInsertOrUpdateCalled);
        Assert.IsTrue(mockCustomerRepo.IsSaveCalled);
    }
}
```

Test Explorer   

 Search 

Run All | Run... ▾

▲ **Failed Tests (1)**

- ✖ ScheduleActionCorre... 28 ms

▲ **Passed Tests (7)**

- ✔ CreateInsertsCustom... 70 ms
- ✔ DeleteConfirmedDel... < 1 ms
- ✔ DeleteFindAndReturns... 3 ms
- ✔ EditUpdatesCustom... < 1 ms
- ✔ IndexReturnsNonNull... 3 ms
- ✔ ItShouldThrowExcept... 41 ms
- ✔ ScheduleActionRetu... 130 ms

Unittests Demo

Datenbanktests

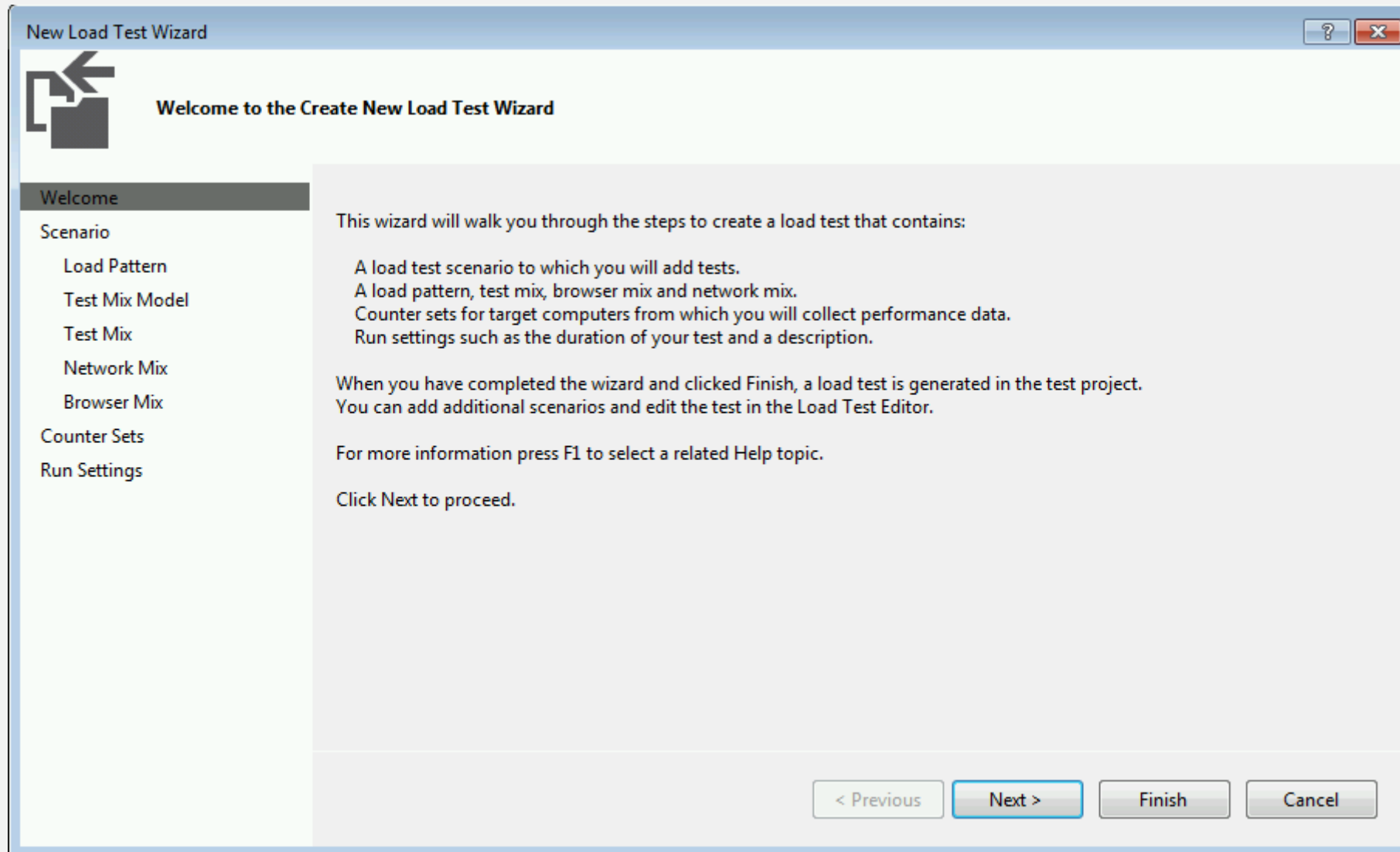
The screenshot displays the Microsoft Visual Studio IDE with the following components:

- Title Bar:** FabrikamFiber.CallCenter - Microsoft Visual Studio (Administrator)
- Menu Bar:** File, Edit, View, Refactor, Project, Build, Debug, Team, SQL, Data, Tools, Unit Test, Architecture, Analyze, Window, Help
- Toolbar:** Includes buttons for Run, Stop, Break, and other development actions.
- Toolbox (Left):** Shows 'Failed Tests (1)' with a test 'S.' that failed in 22 ms, and 'Passed Tests (8)' with a list of successful tests and their durations.
- Code Editor (Center):** Displays the code for `UnitTest1.cs` within the `WebAndLoadTestProject1` namespace. The code defines a `TestClass` `UnitTest1` with a `TestMethod` `DatabaseSelectEmployee()` that uses LINQ to query a database for employees with the last name 'Keller'.
- Solution Explorer (Right):** Shows the project structure, including load tests (`LoadTest5.loadtest`, `LoadTest6.loadtest`), a model (`Model1.edmx`), and web tests (`WebTest1.webtest` through `WebTest6.webtest`). The `UnitTest1.cs` file is currently selected.
- Properties Window (Bottom Right):** Shows the 'Properties' tab for the selected file.

```
using System;
using Microsoft.VisualStudio.TestTools.UnitTesting;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace WebAndLoadTestProject1
{
    [TestClass]
    public class UnitTest1
    {
        [TestMethod]
        public void DatabaseSelectEmployee()
        {
            Entities db = new Entities();
            var employee = from e in db.Employees
                           where e.LastName == "Keller"
                           select new { e.FirstName, e.LastName };
        }
    }
}
```

Einzeltests in Lasttest verwenden



Think Times

New Load Test Wizard

Edit settings for a load test scenario

Welcome

Scenario

Load Pattern

Test Mix Model

Test Mix

Network Mix

Browser Mix

Counter Sets

Run Settings

Enter a name for the load test scenario:

Scenario1

Think time profile

☒ Use recorded think times

☐ Use normal distribution centered on recorded think times

☐ Do not use think times

Think time between test iterations: 0 seconds

< Previous

Next >

Finish

Cancel

Anzahl der simulierten Benutzer

New Load Test Wizard

Edit load pattern settings for a load test scenario

Welcome
Scenario
Load Pattern
Test Mix Model
Test Mix
Network Mix
Browser Mix
Counter Sets
Run Settings

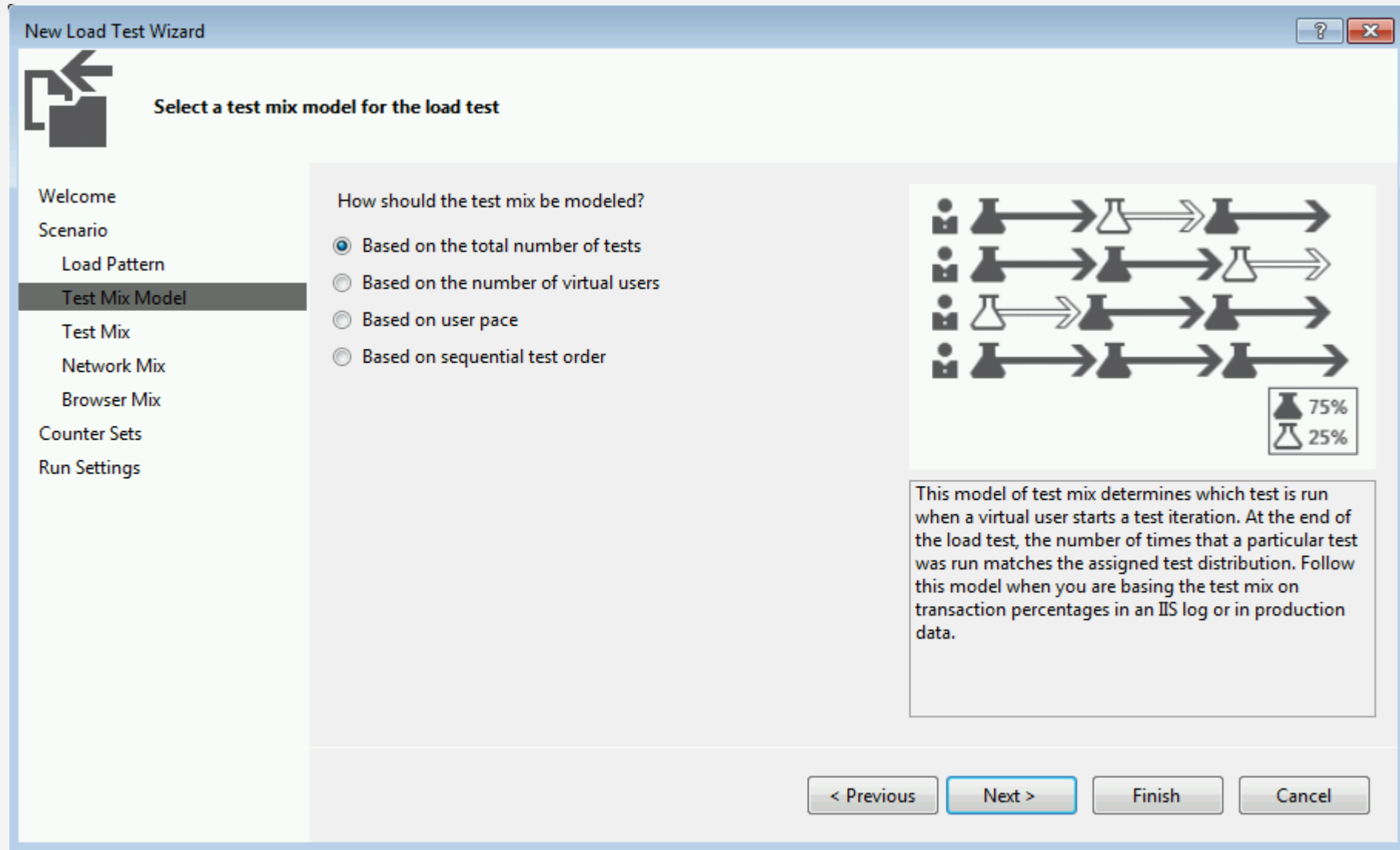
Select a load pattern for your simulated load:

☐ Constant Load:
User Count: 25 users

☒ Step load:
Start user count: 10 users
Step duration: 10 seconds
Step user count: 10 users/step
Maximum user count: 200 users

< Previous Next > Finish Cancel

Test mix model



Einzeltests und Verteilung

New Load Test Wizard

Add tests to a load test scenario and edit the test mix

Welcome

Scenario

- Load Pattern
- Test Mix Model
- Test Mix**
- Network Mix
- Browser Mix

Counter Sets

Run Settings

Add one or more tests to the mix:

	Test Name	%	Distribution	
1	CreateInsertsCustomerAndSaves	32		<input checked="" type="checkbox"/>
2	DeleteConfirmedDeletesCustomerAndSaves	22		<input checked="" type="checkbox"/>
3	DeleteFindAndReturnsCustomer	6		<input type="checkbox"/>
4	EditUpdatesCustomerAndSaves	15		<input checked="" type="checkbox"/>
5	WebTest1	5		<input type="checkbox"/>
6	WebTest2	6		<input type="checkbox"/>
7	WebTest3	7		<input type="checkbox"/>
8	WebTest3Coded	7		<input type="checkbox"/>

Add...

Remove

Distribute

< Previous

Next >

Finish

Cancel

Netzwerkbandbreite und Verteilung

[illegible]

Browser Mix

New Load Test Wizard

Add browser types to a load test scenario and edit the browser mix

Welcome

Scenario

Load Pattern

Test Mix Model

Test Mix

Network Mix

Browser Mix

Counter Sets

Run Settings

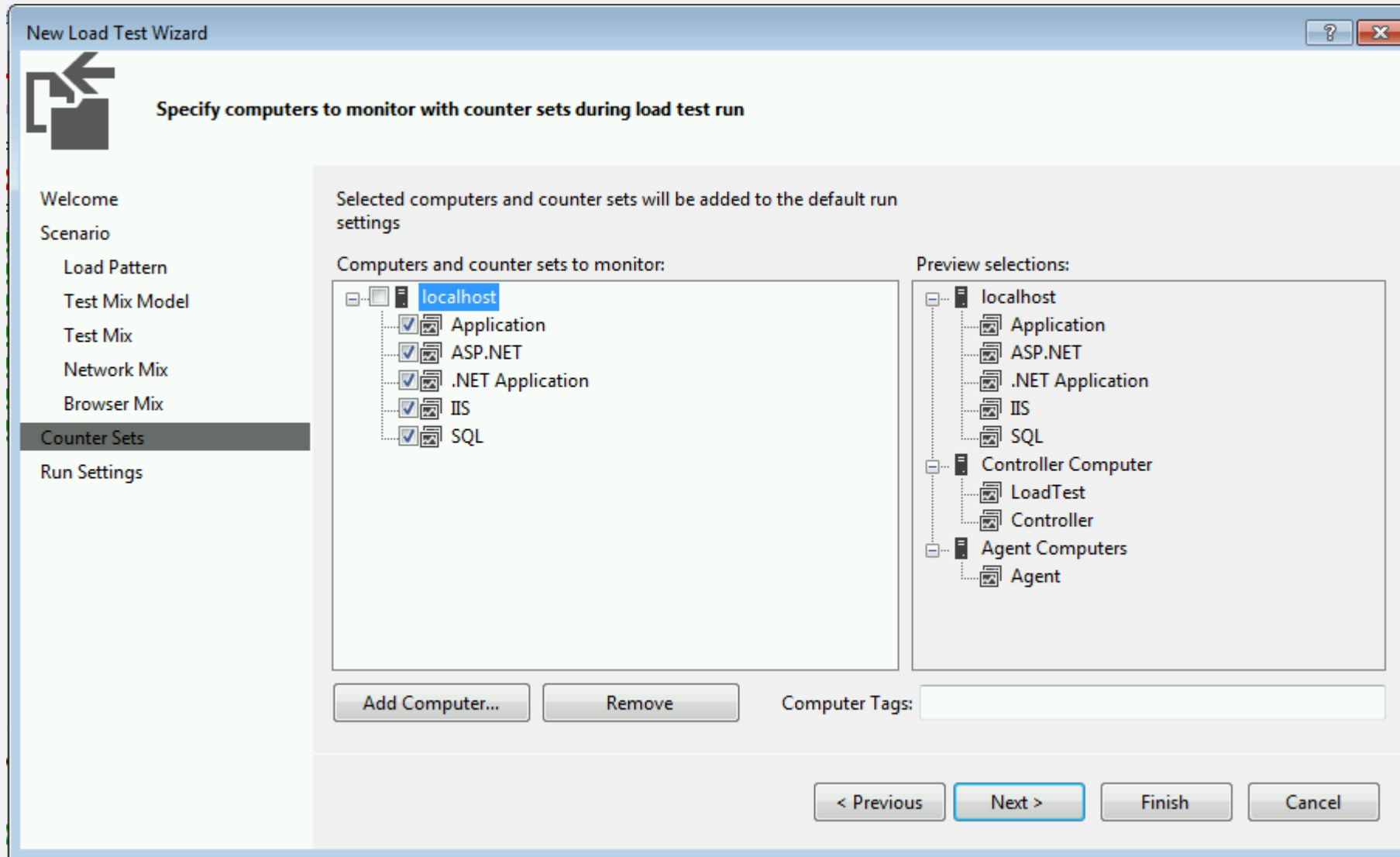
Add one or more browser types to the mix and specify a distribution:

	Browser Type	%	Distribution	
1	Internet Explorer 9.0	32		<input checked="" type="checkbox"/>
2	Chrome 2	11		<input checked="" type="checkbox"/>
3	Firefox 2.0	9		<input checked="" type="checkbox"/>
4	Firefox 3.0	6		<input checked="" type="checkbox"/>
5	Internet Explorer 10.0	42		<input type="checkbox"/>
Total		100		

Add Remove Distribute

< Previous Next > Finish Cancel

Performance Counter



Testdauer

New Load Test Wizard

Review and edit run settings for a load test

Welcome

Scenario

- Load Pattern
- Test Mix Model
- Test Mix
- Network Mix
- Browser Mix

Counter Sets

Run Settings

Specify the length of the load test by:

☒ **Load test duration**

Warm-up duration (hh mm ss): 0 0 0

Run duration (hh mm ss): 0 3 0

☐ **Test iterations**

Test iterations: 100

Details

Sampling rate: 5 seconds

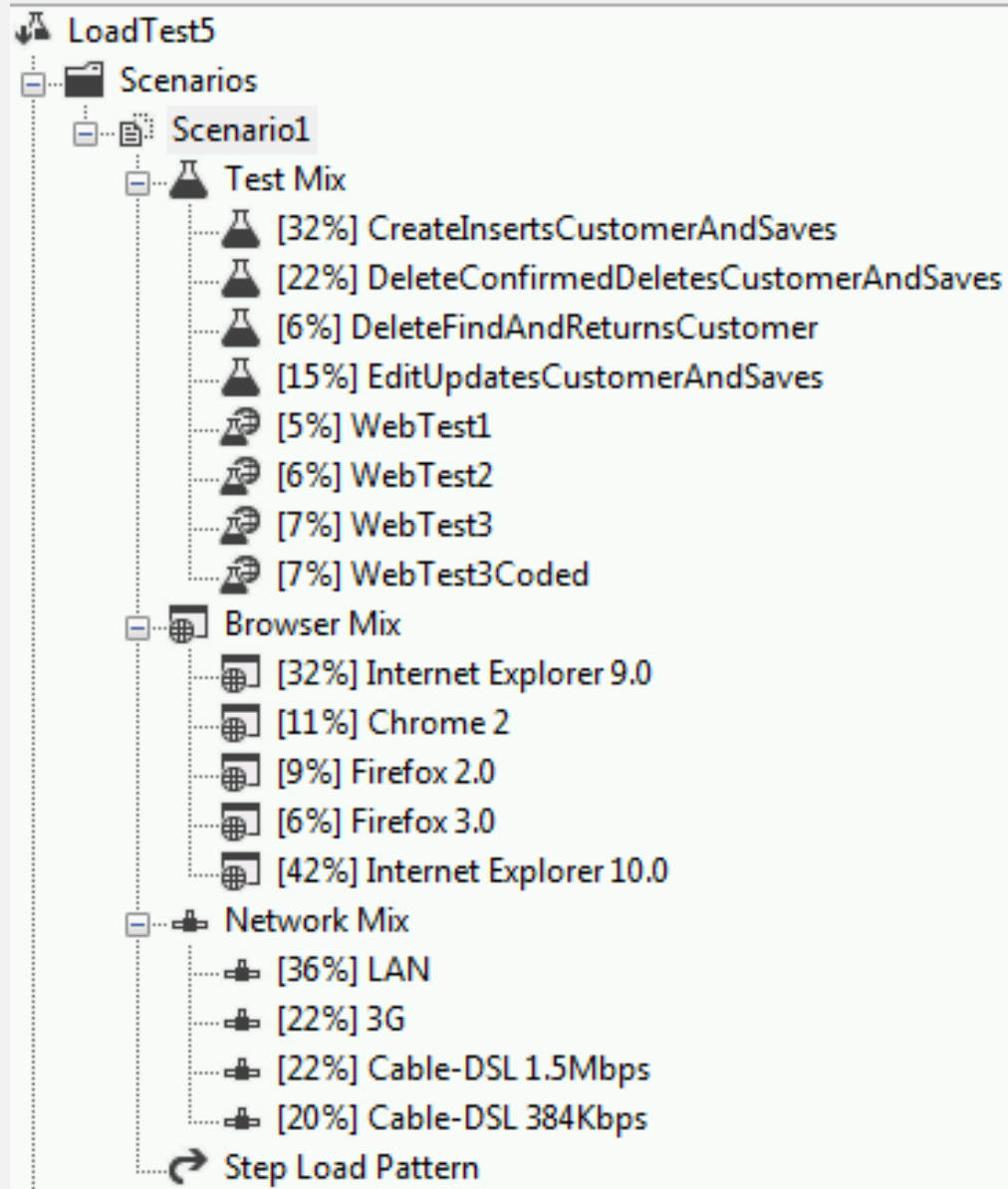
Description:

Save Log on Test Failure: True

Validation level: High - invoke all validation rules

< Previous Next > Finish Cancel

Loadtest



WebTest Connections

WebTest Connection Model

Connection Per User

WebTest Connection Pool Size

Connection Per User

Connection Pool

Connection Per Test Iteration

WebTest Connection Model

Select a connection model for Web tests. 'Connection Per User' uses dedicated connections to conserve resources; 'Connection Per User': use dedicated connections to conserve resources; 'Connection Per User': use dedicated connections to conserve resources.

Options

Agents to Use

Apply Distribution to Pacing Delay

True

IP Switching

True

Maximum Test Iterations

0

Percentage of New Users

0

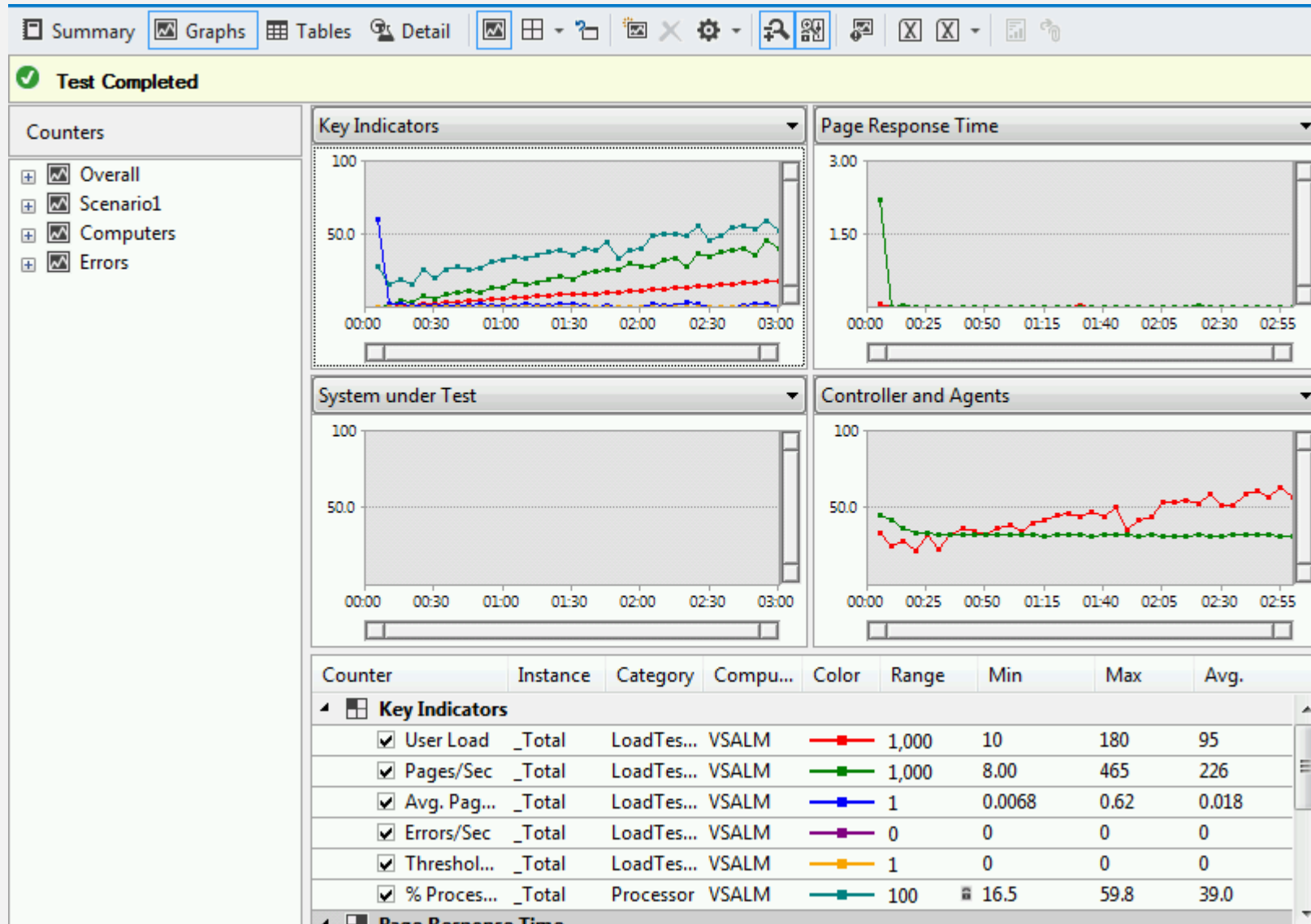
Think Profile

On

Think Time Between Test Iterations

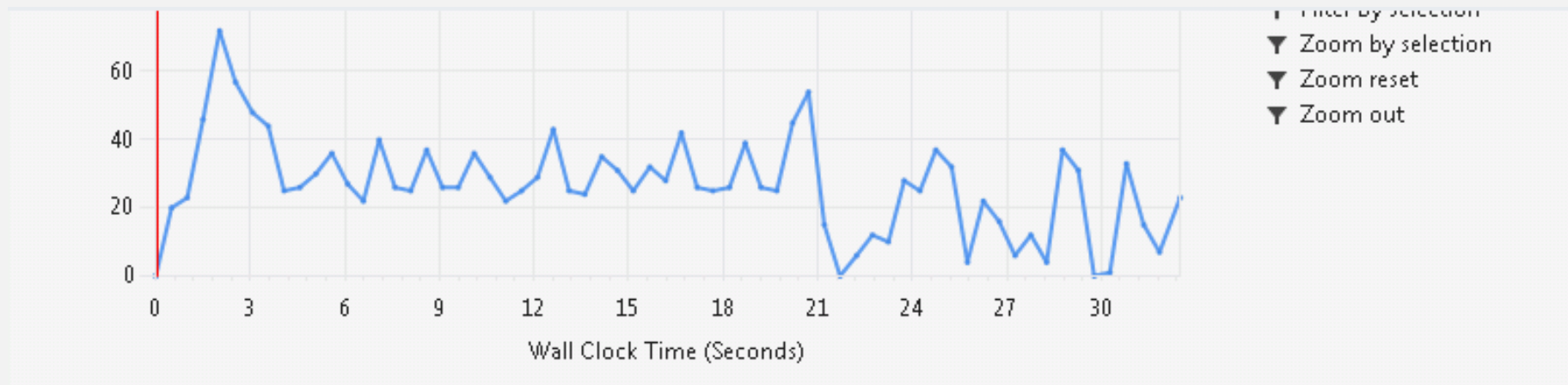
0

Testergebnis



Loadtest Demo

Profiler zum Ermitteln der Engpässe



Hot Path

Function Name	Inclusive Samples %	Exclusive Samples %
WebDev.WebServer40.EXE	100.00	0.00
FabrikamFiber.Web.Controllers.HomeController.Index()	68.87	0.00
FabrikamFiber.DAL.Data.ServiceTicketRepository.AllIncluding(class System.Linq.Ex...	68.68	0.00
System.Data.Entity.DbExtensions.Include(class System.Linq.IQueryable`1...	68.62	68.62

Related Views: [Call Tree](#) [Functions](#)

Functions Doing Most Individual Work

Name	Exclusive Samples %
System.Data.Entity.DbExtensions.Include(class System.Linq.IQueryable`1<!!0>,class System.Linq.Expressions....	68.68
System.Data.Entity.DbContext..ctor(string)	4.10
System.Dynamic.UpdateDelegates.UpdateAndExecute2(class System.Runtime.CompilerServices.CallSite,!!0,!!...	3.59

Analyse bis auf Zeilenebene

Function Code View

c:\ws\brian\ff\Dev\FabrikamFiber.CallCenter\FabrikamFiber.DAL\Data\ServiceTicketRepository.cs

```
{  
    get { return this.context.ServiceTickets; }  
}  
  
public IQueryable<ServiceTicket> AllIncluding(params Expression<Func<ServiceTicket, object>>[])  
{  
    IQueryable<ServiceTicket> query = this.context.ServiceTickets;  
  
    foreach (var includeProperty in includeProperties)  
    {  
        query = query.Include(includeProperty);  
    }  
}
```

68.7 %

Profiler

Demo

Beispiel Windows Live Hotmail

- about 8 million customers in 1997 to over 260 million customers worldwide
- Web Testing and Load Testing capabilities of Visual Studio
- support 215,000 concurrent clients

Establishing a Baseline

The image shows a Visual Studio interface with the 'WindowsLiveHotmail.loadtest' project open. The 'Properties' window is visible on the left, showing the 'TestProject.WindowsLiveHotmailCoded' property. The main code editor displays the 'WindowsLiveHotmailCoded.cs' file, which contains the following code:

```
public class windowsLiveHotmailCoded : WebTest
{
    public windowsLiveHotmailCoded()
    {
        this.PreAuthenticate = true;
    }
    public override IEnumerable<WebTestRequest> GetRequestEnumerator()
    {
        WebTestRequest request1 = new WebTestRequest("http://www.hotmail.com");
        ExtractHiddenFields rule1 = new ExtractHiddenFields();
        rule1.ContextParameterName = "1";
        request1.ExtractValues += new EventHandler<ExtractionEventArgs>(request1.ExtractValues_EventHandler);
        yield return request1;

        WebTestRequest request2 = new WebTestRequest("http://hm.msn.com");
        request2.Body = request1.Body;
        yield return request2;

        WebTestRequest request3 = new WebTestRequest("http://hm.msn.com");
        request3.Body = request2.Body;
        yield return request3;

        WebTestRequest request4 = new WebTestRequest("http://hm.msn.com");
        request4.Body = request3.Body;
        yield return request4;

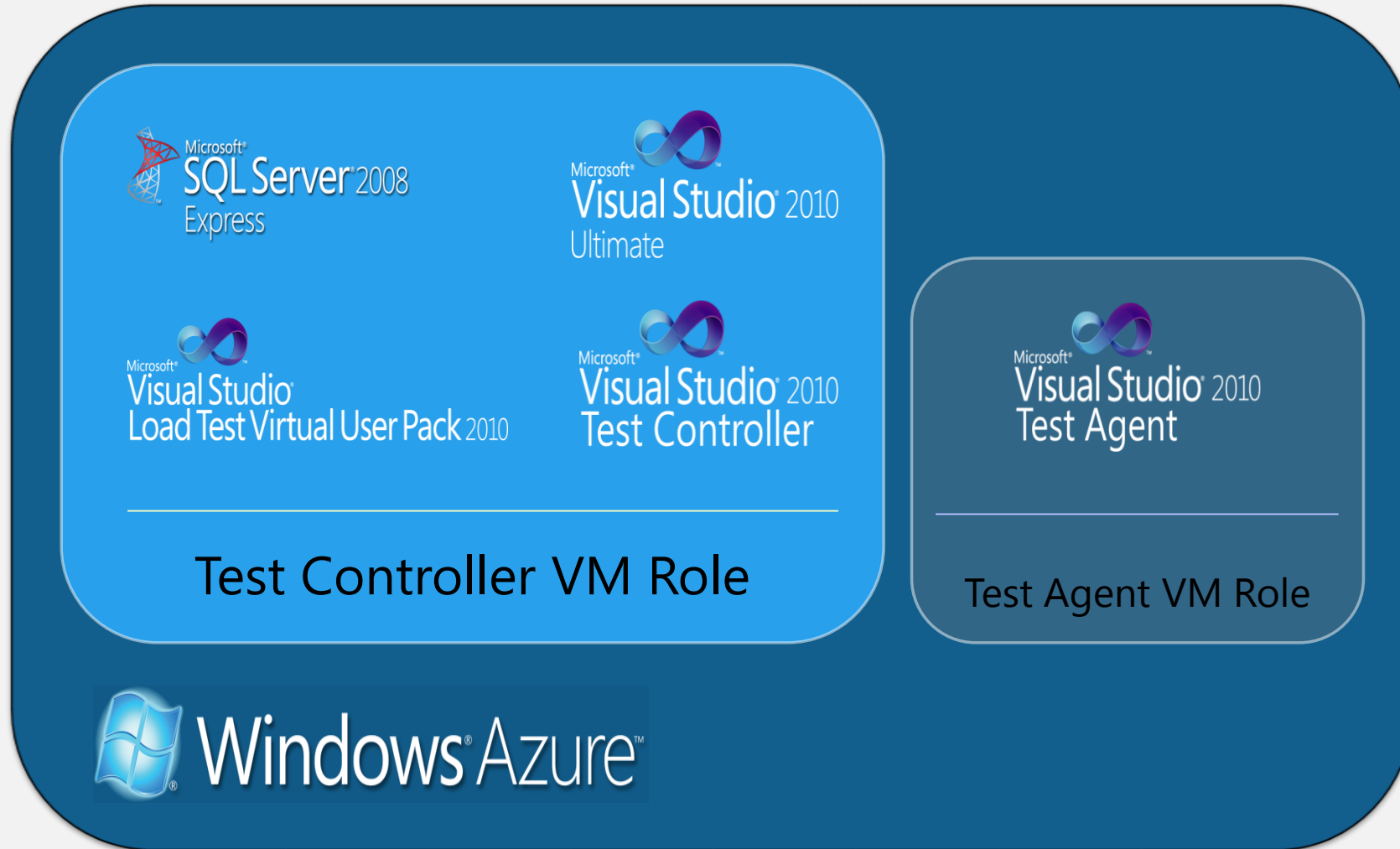
        WebTestRequest request5 = new WebTestRequest("http://hm.msn.com");
        request5.Body = request4.Body;
        yield return request5;

        WebTestRequest request6 = new WebTestRequest("http://hm.msn.com");
        request6.ThinkTime = 10;
        yield return request6;
    }
}
```

A tooltip for the `ThinkTime` property is shown at the bottom right:

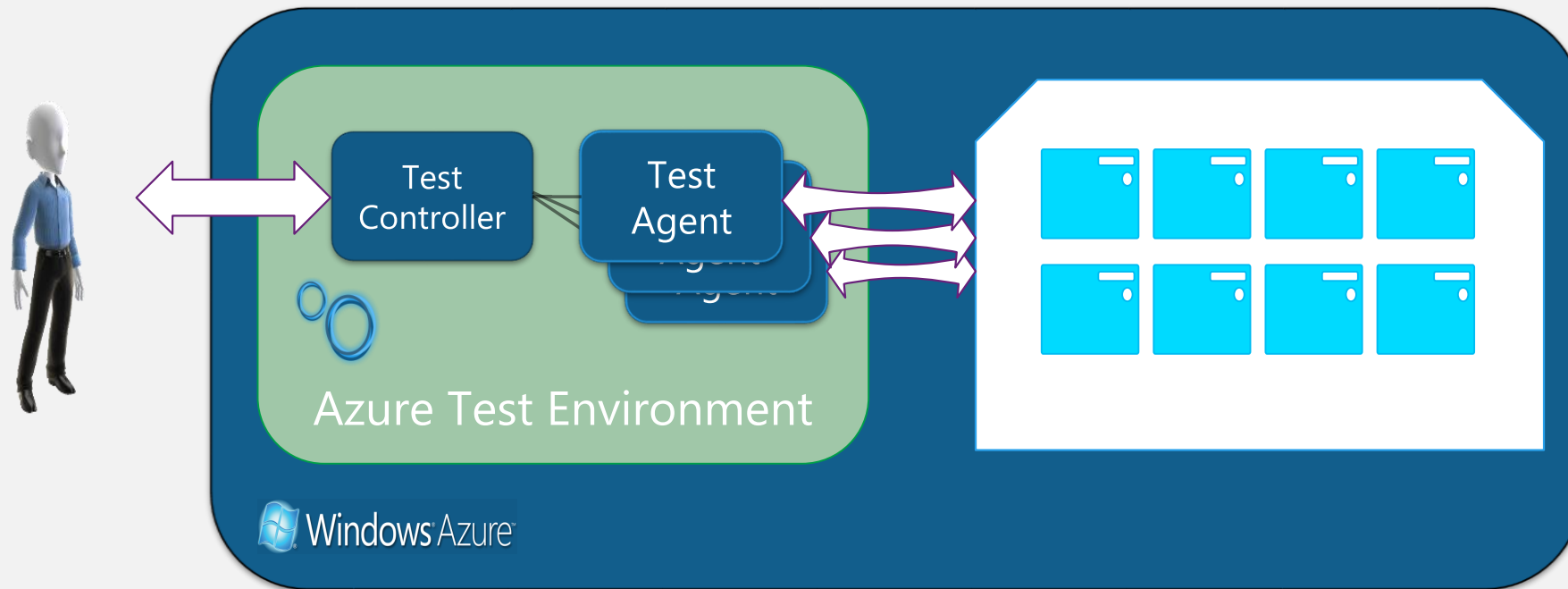
```
int WebTestRequest.ThinkTime
Gets or sets a value representing the think time to wait after the response is received.
```

ATE Ingredients



ATE = Azure Test Environment von Microsoft Consulting Services

Cloud-Anwendung testen



Weitergehende Informationen

Visual Studio Performance Testing (not so) Quick Reference Guide

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

Visual Studio Performance Testing Quick Reference Guide

6/20/2011

Fragen? Danke!

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