

# Performance

Microsoft Dynamics CRM 3.0

## Service Scheduling Performance and Scalability Study

White Paper

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## Credits

This document was initiated and developed by the CRM Engineering for Enterprise Team. We hereby acknowledge the following individuals for their time and effort in contributing to and reviewing this document, which is intended to support the broader CRM community.

### Key Contributors

Brian Bakke (*Microsoft*)

Grant Geiszler (*Microsoft*)

### Technical Reviewers

Aaron Elder (*Ascentium*)

Barry Givens (*Microsoft*)

Wilfred Schmidt (*Microsoft*)

## Feedback

To provide comments or suggestions on this document, please email [entfeed@microsoft.com](mailto:entfeed@microsoft.com).

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## Executive Overview and Capsule Results

The Microsoft CRM Product Group engaged the Business Systems Architecture (BSA) team to complete a performance and scalability test of the Microsoft Dynamics™ CRM 3.0 Service Scheduling module against a specific set of metrics (user counts, transaction volumes, data set size, etc.) provided by the Product Group.

The primary goals of the performance tests on the Service Scheduling module were to:

- Determine how the module performed against an environment defined by metrics provided by the Microsoft Dynamics CRM Product Group.
- Identify any server performance bottlenecks under the proposed configuration and test mix (a load of 560 total users; up to 46 concurrent).
- Assess the application performance of the user, data and transaction volumes and the overall suitability of the test infrastructure.
- Provide performance benchmark data on the proposed infrastructure.

These tests demonstrated that a large, high performance service scheduling solution can be built on the Microsoft Dynamics CRM 3.0 application. The testing showed the significant performance gains achieved by optimizing the deployment infrastructure and solution design based on the prescriptive guidance provided in the complementary white paper *Service Scheduling: Optimizations and Considerations*.

### Capsule Results

This document contains details regarding three (3) separate load tests.

The following table provides an overview of the load test results:

| Test Case | Test Duration | Total Tests | Tests / Sec | Test Completion Time (Seconds) |
|-----------|---------------|-------------|-------------|--------------------------------|
| Test 1    | 8 hours       | 1703        | 0.059       | 0.66 – 1.97                    |
| Test 2    | 12 hours      | 2546        | 0.059       | 0.55 – 2.25                    |
| Test 3    | 40 hours      | 9741        | 0.068       | 0.65 – 3.8                     |

**Note:** The *Features and Functionality Tested* section of this document provides details of these tests, while the *Performance/Functionality Test* section presents the associated test results.

## Test Scenario

The customer is a multi-site maintenance and engineering firm that manages the fire, plumbing, Heating, Ventilation, and Air Conditioning (HVAC), and electrical systems for commercial buildings. The firm schedules regular maintenance on buildings and also dispatches service personnel on demand. Personnel across fire, HVAC, electrical and plumbing have unique skills and are not cross trained. Each person works from a single site but is scheduled using a central dispatch service.

|  |   |
|--|---|
| <b>Infrastructure</b>                  | <ul style="list-style-type: none"> <li>▪ 20 sites</li> <li>▪ 28 users per site</li> <li>▪ 4 Resource Groups per site               <ul style="list-style-type: none"> <li>○ Fire Suppression</li> <li>○ Plumbers</li> <li>○ Electricians</li> <li>○ HVAC Engineer</li> </ul> </li> <li>▪ 7 users per resource group per site</li> </ul>   |
| <b>Working Hours</b>                   | <ul style="list-style-type: none"> <li>▪ The calendar for each resource includes 12 hours of availability over a four day period</li> <li>▪ Business hours run from 8 AM to 8 PM, seven days a week</li> <li>▪ Resources are evenly scheduled over the seven day period</li> <li>▪ 16 resources are on staff per day</li> </ul>   |
| <b>Service Types</b>                   | <ul style="list-style-type: none"> <li>▪ Two hour services (one hour to five days in advance)</li> <li>▪ Half hour services (one hour to five days in advance)</li> <li>▪ Two hour maintenance service (one month in advance)</li> <li>▪ Reschedule of an existing service</li> <li>▪ Cancellation of an existing service</li> </ul>  |
| <b>Services</b>                        | <ul style="list-style-type: none"> <li>▪ Twelve services configured               <ol style="list-style-type: none"> <li>1. Fire Suppression System Maintenance (2 hour duration)</li> <li>2. Plumbing Maintenance (2 hour duration)</li> <li>3. Electrical Inspection (2 hour duration)</li> <li>4. HVAC Maintenance (2 hour duration)</li> <li>5. Fire Suppression System Service (2 hour duration)</li> <li>6. Plumbing Service (2 hour duration)</li> <li>7. Electrical Service (2 hour duration)</li> <li>8. HVAC Service (2 hour duration)</li> <li>9. Fire Suppression System Service (0.5 hour duration)</li> <li>10. Plumbing Service (0.5 hour duration)</li> <li>11. Electrical Service (0.5 hour duration)</li> <li>12. HVAC Service (.5 hour duration)</li> </ol> </li> <li>▪ Requests can be made against any resource</li> </ul> |
| <b>Input Data Required by Services</b> | <ul style="list-style-type: none"> <li>▪ Site Name</li> <li>▪ Service Name</li> <li>▪ Start Date (variable input dependant on service type)</li> </ul>  |

|                           |   |
|---------------------------|---|
| <b>Required Resources</b> | <ul style="list-style-type: none"> <li>▪ Each service requires its respective resource group (i.e. Electrical services require Electricians)</li> <li>▪ A single resource is required for each service</li> <li>▪ The Scheduling objective is set to Random (the default)</li> <li>▪ There are no capacity constraints</li> </ul>   |
| <b>Test Assumptions</b>   | <ul style="list-style-type: none"> <li>▪ Resources are typically scheduled to 50% capacity with scheduled maintenance one month in advance while the emergent services are scheduled from four days to one hour in advance.</li> <li>▪ Prior to the actual load testing of the Service Scheduling module, the database will be pre-populated with data and each resource (user) will have approximately three (3) maintenance services scheduled per shift, per day for the forthcoming six week period.</li> <li>▪ Because not all workers work every day there are 16 workers for each site for each working day.</li> <li>▪ For each site 8 services are scheduled per user per day ((8 requests * 16 users per site) * 20 sites = 2560 requests per day/12 hours = 213.3 requests per hour = 3.5 requests per minute).</li> </ul> |

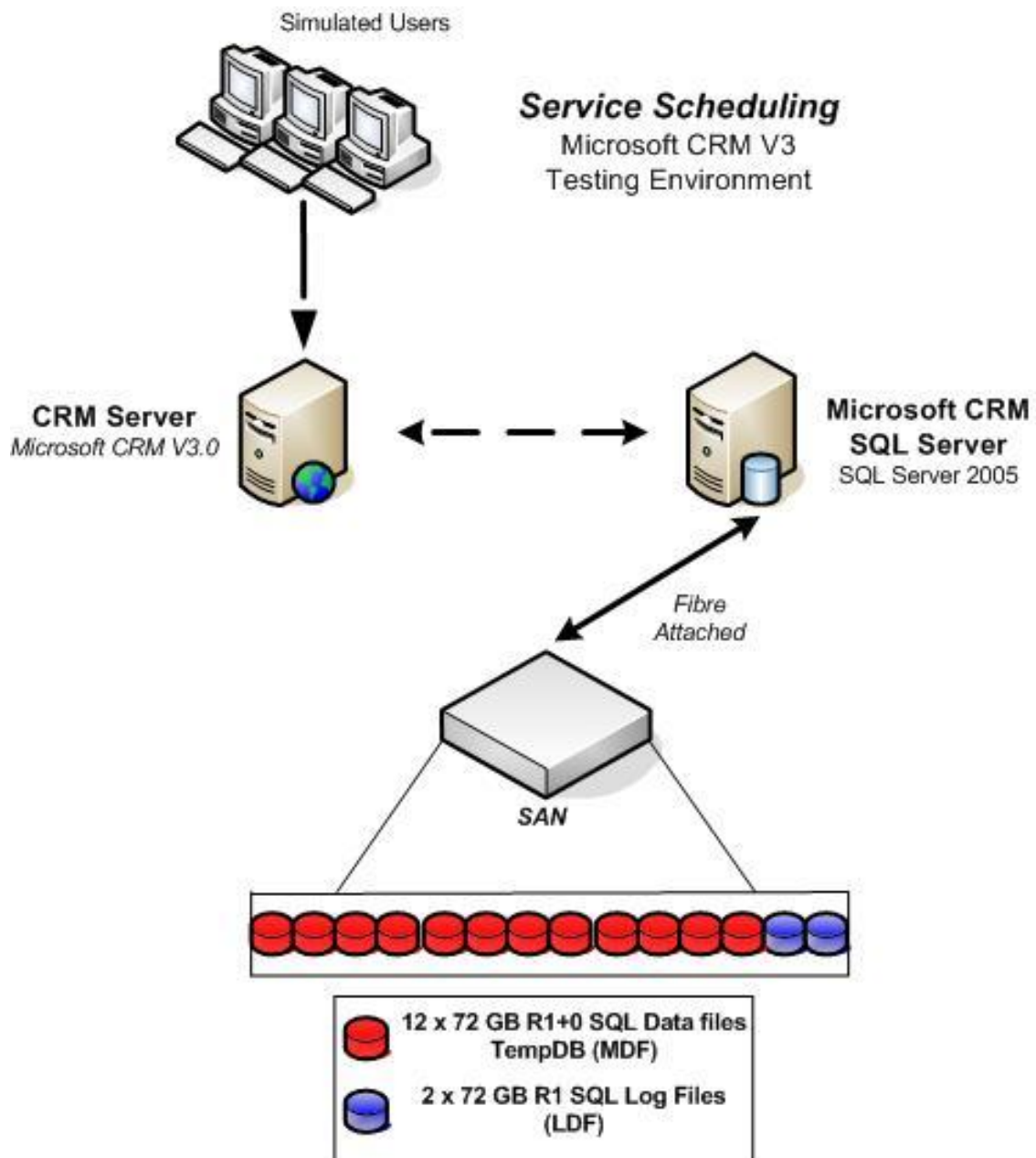
## Load Test Environment

The tests were executed at the BSA Lab in Fargo, ND. The test environment was dedicated to the testing of the service scheduling scenario and was isolated from any other network traffic or application overhead. Keep this in mind as the test results are compared to actual production environment performance.

The test environment was installed and configured per the preferred practices to deploy Microsoft Dynamics CRM 3.0 as outlined in the Microsoft CRM 3.0 Implementation Guide.

### Environment Overview

The following infrastructure was used for load testing purposes:



## Detailed Test Environment Architecture

### SQL Database Server

For testing purposes, a single, non-clustered computer running Microsoft SQL Server™ was used and was dedicated to the Microsoft Dynamics CRM databases. The server was configured per preferred practices outlined in the Microsoft CRM 3.0 Implementation Guide.

| Test SQL Server             |                     |                                 |
|-----------------------------|---------------------|---------------------------------|
| Processors                  | Four (4) Processors | Single Core                     |
| RAM                         | 32 GB               | Ability to scale to 32 GB       |
| Internal Storage Definition | Disk 0              | 2 Disk (15K, 72GB) RAID 1       |
| Internal Storage            | Disk 0 (C:)         | Operating System / SQL Binaries |
| External Storage HBA        | 2 GB Fibre          |                                 |
| Network Adapter             | 1 GB Fibre          |                                 |
| OS and Middleware           |                     |                                 |
| Windows Server®             | 2003 R2 SP1         | Enterprise, 64-bit              |
| Microsoft SQL Server        | 2005 SP1            | Enterprise, 64-bit              |

### External Storage

We typically recommend a dedicated, physical disk approach for configuring Microsoft Dynamics CRM databases and Microsoft Dynamics CRM database log files. It has been our experience that physically separating the data and log files improves performance over non-dedicated configurations. However, a non-dedicated disk configuration is supported but disk performance should be closely monitored to ensure the Microsoft Dynamics CRM databases have sufficient disk resources. The following is the dedicated disk SAN configuration used for the performance testing:

| SAN                   |            |  |
|-----------------------|------------|--|
| Connection            | 2 GB Fiber | Redundant  |
| Switch                | 2/8        |  |
| Disk Configuration    |            |  |
| 12 x 72 GB 15K RPM HD | RAID 1+0   | CRM, METABASE, TempDB, SQL Server Data File (.mdf) |
| 2 x 72 GB 15K RPM HD  | RAID 1     | CRM, METABASE, TempDB SQL Server Log File (.ldf)   |

**Note:** Adding spindles to the data set array should increase performance, if disk I/O becomes an issue. For optimal performance the SQL Log files and Data files should be physically separated, per Microsoft preferred practices. For best performance, physical disks should be dedicated to each array in the previous chart. For example, the RAID 1+0 Array for the SQL Data Files (MDF) only contains the SQL MDF files and should not be logically partitioned to host other applications.

### Microsoft Dynamics CRM Application Server

As the demands on the Microsoft Dynamics CRM system grow, the Microsoft Dynamics CRM application server can be scaled up by adding server resources and scaled out by adding servers. For example, as more users are brought on to the system, additional servers could be added to the application server farm to handle the additional load as needed.

A single Microsoft CRM application server was used for the service scheduling scenario testing. The server was configured per the preferred practices in the Microsoft CRM 3.0 Implementation Guide.

| <b>Test CRM Server</b>      |                |                                  |
|-----------------------------|----------------|----------------------------------|
| Processors                  | Dual Processor | Single core                      |
| RAM                         | 2 GB           |                                  |
| Internal Storage Definition | Disk 0         | 2 Disk (15K, 36GB) RAID 1        |
| Internal Storage            | Disk 0 (C:)    | Operating System / Install files |
| Network Adapter             | 1 GB           |                                  |
| <b>OS and Middleware</b>    |                |                                  |
| Windows Server              | 2003 R2 SP1    | Standard, 32-bit                 |
| Microsoft CRM               | 3.0            |                                  |

### Active Directory Domain Controller

The Microsoft Dynamics CRM test environment contained a single Active Directory domain controller in a single Active Directory Forest and single Domain for testing. A single organizational unit was created for the service scheduling scenario performance testing. The domain was configured per preferred practices outlined in the Microsoft CRM 3.0 Implementation Guide.

| <b>Active Directory Domain Controller</b> |                |                                  |
|---|----------------|----------------------------------|
| Processors                                | Dual Processor | Single core                      |
| RAM                                       | 2 GB           |                                  |
| Internal Storage Definition               | Disk 0         | 2 Disk (15K, 36GB) RAID 1        |
| Internal Storage                          | Disk 0 (C:)    | Operating System / Install files |
| Network Adapter                           | 1 GB           |                                  |
| <b>OS and Middleware</b>                  |                |                                  |
| Windows Server                            | 2003 R2 SP1    | Standard, 32-bit                 |

### Load Test Injector Agent

A single load test injector agent was used to simulate Microsoft Dynamics CRM users in the test environment. The agent was configured per preferred practices as outlined in the Microsoft CRM Performance Toolkit documentation.

| <b>Load Simulator</b>       |                   |                                  |
|-----------------------------|-------------------|----------------------------------|
| Processors                  | Dual Processor    | Single core                      |
| RAM                         | 2 GB              |                                  |
| Internal Storage Definition | Disk 0            | 2 Disk (15K, 72GB) RAID 1        |
| Internal Storage            | Disk 0 (C:)       | Operating System / Install files |
| Network Adapter             | GB                |                                  |
| <b>OS and Middleware</b>    |                   |                                  |
| Windows Server              | 2003 R2 SP1       | Enterprise, 32-bit               |
| Microsoft Office            | 2007              |                                  |
| Visual Studio®              | 2005 Team Edition |                                  |
| Microsoft CRM Test Toolkit  |                   |                                  |

# Microsoft Dynamics CRM Testing Setup

The Microsoft Dynamics CRM 3.0 Performance and Stress Test Toolkit was used to complete the load testing for the service scheduling scenario project. Since the default test scripts that come with the toolkit can only be used for the Microsoft CRM Sales Module, the Business Systems Architecture (BSA) team needed to create custom test scripts to simulate the service scheduling activity.

**Note:** For information about or to download the Microsoft Dynamics CRM 3.0 Performance and Stress Testing Toolkit, see <http://www.microsoft.com/downloads/details.aspx?familyid=1a25db7c-5060-417c-86db-6377a84ee650&displaylang=en>

The tests simulated users executing a series of real-world business transactions. Each business transaction is composed of a set of discrete user interactions with the Microsoft Dynamics CRM system. For example, the business transaction "Add work hours" consists of the following discrete CRM interactions:

## Test Steps:

1. Select 'Settings' from the Navigation Pane
2. Select 'Business Unit Settings' and 'Users'
3. Select the 'Full Name' button from the list. New user window appears
4. Select "Work Hours" node
5. Select "Set Up" and then "New Weekly Schedule"
6. Choose appropriate schedule for technician
7. Save and close

Each discrete interaction is itself comprised of one or more atomic CRM commands. On average each business transaction represents 5-10 atomic Microsoft Dynamics CRM commands and takes anywhere from 1 to 41 seconds to realistically execute.

The Microsoft CRM 3.0 Performance Testing Toolkit was used as the basis for generating the simulated user action as well as all relevant scripts.

## Test User Overview

To simulate the activities of Microsoft CRM users at service scheduling, a pool of 560 test users were created in the domain for use by the load test tools. All users were created with the "crmusr" prefix and the same domain password. 46 concurrent users were assumed for testing purposes.

## Data Load

Accurately testing performance requires realistic data in the Microsoft CRM database. For purposes of performance testing, Microsoft® configured the service scheduling requirements (sites, resource groups, and services), and used a web test to create the beginning data.

**Note:** During the testing process, the database accumulated additional data, which is outlined in Appendix E.

## Features and Functionality Tested

Microsoft CRM testing objectives were to analyze the performance of the workload to ensure that the hardware was appropriately sized and that the response times for each test case were within acceptable performance ranges. Details of each testing phase are available in Appendix B.

### System Metrics

| Metric   | Value  |
|--|--|
| Total users defined in the system                            | 560 licensed Microsoft CRM users                         |
| Resources in the system                                      | 560 service technicians (not Microsoft CRM users)        |
| Concurrent users logged into the system at any point in time | 46 using the service calendar<br>Service Technician Role |
| Total service activities made per day                        | 2,560 scheduled service activities (jobs) per day        |
| Expected total number of service sites                       | 20   |
| Expected number of users/service site                        | 28   |
| Expected number of services per user per day                 | 8  |
| Expected number of users per site                            | 16   |
| Expected duration of work day                                | 12 hours   |
| Expected number of service activities/service center         | 128  |
| Expected total hourly requests                               | 213  |
| Expected total requests per minute                           | 3.5  |

### Test Case Definitions

This document refers to the business processes to be tested as “Test Cases,” and each test case is assigned a number. The following table defined the test cases and the number of times each test will be conducted each day:

|             | Definition  |
|-------------|---|
| Test Case 1 | <ul style="list-style-type: none"> <li>▪ Create a two (2) hour service (one hour to five days in advance)</li> <li>▪ Three (3) of these test cases will be completed per user per day per site</li> </ul> |
| Test Case 2 | <ul style="list-style-type: none"> <li>▪ Create a 0.5 hr service (one hour to five days in advance)</li> <li>▪ Two (2) of these test cases will be completed per user per day per site</li> </ul>         |
| Test Case 3 | <ul style="list-style-type: none"> <li>▪ Create a two (2) hour maintenance service (one month in advance)</li> <li>▪ One (1) of these test cases will be completed per user per day per site</li> </ul>   |
| Test Case 4 | <ul style="list-style-type: none"> <li>▪ Reschedule an existing service</li> <li>▪ One (1) of these test cases will be completed per user per day per site</li> </ul>                                     |
| Test Case 5 | <ul style="list-style-type: none"> <li>▪ Cancel an existing service</li> <li>▪ One (1) of these test cases will be completed per user per day per site</li> </ul>   |

**Note:** This reflects a total of eight (8) test cases per user per day per site.

### Test cases/transaction data

|             | Test Name                         | Site<br>(Per Day) | Site<br>(Per Hour) | Org<br>(Per Hour) | Org<br>(Per Day) |
|-------------|-----------------------------------|-------------------|--------------------|-------------------|------------------|
| Test Case 1 | Create 2-Hour Service             | 48                | 4.00               | 80.00             | 960              |
| Test Case 2 | Create 30-minute Service          | 32                | 2.67               | 53.33             | 640              |
| Test Case 3 | Create 2-Hour Maintenance Service | 16                | 1.33               | 26.67             | 320              |
| Test Case 4 | Reschedule Existing Service       | 16                | 1.33               | 26.67             | 320              |
| Test Case 5 | Cancel Existing Service           | 16                | 1.33               | 26.67             | 320              |
| Total       |                                   | 128               | 10.67              | 213.33            | 2560             |

**Note:** Organizational (Org) totals are assuming 20 sites processing the same amount of data as listed in the Site (per day) column.

**Note:** The data used for these calculations includes:

- Number of services per user per day: 8
- Number of total users per site: 28
- Number of staffed users per site: 16
- Number of sites: 20
- Number of hours in work day: 12

## Performance Monitoring Approach

The “acceptable” ranges discussed in this section are common, industry standard ranges for performance monitoring. Defining acceptable ranges makes it simpler to interpret the results of the tests and provide a starting point for determining system performance.

Focusing initially on the “big picture” components, drilling down for more detail as indicated, provides a general understanding of how the servers are performing, while reviewing Performance Monitor details helps to determine potential performance bottlenecks.

The following table describes the key performance areas of initial focus.

| Area     | Description   |
|----------|---|
| CPU      | Monitor the CPU load to ensure it does not exceed 80% capacity on a consistent basis. If the % Total Processor Time counter exceeds 80% for continuous periods (over 10 minutes or so), there may have a CPU bottleneck on the server. Occasional spikes over 80% are typical for most servers.   |
| Memory   | For maximum server performance, the server requires sufficient memory to avoid paging by the operating system. Initial focus will be on the Memory Object: Available Bytes counter. As the Available Bytes counter decreases, paging increases, which slows down the server.<br><br>On a server dedicated to SQL Server, SQL Server attempts to maintain between 4-10MB of free physical memory. The remaining physical RAM is used by the operating system and SQL Server. When available bytes are less than 4MB, SQL Server is likely paging, experiencing a decrease in performance.  |
| Disk I/O | When a disk I/O subsystem works efficiently, server can write or read data without waiting. But when the server load is too great, the server has to wait to perform reads and writes, each in its own turn. This can significantly reduce a server's performance, especially on a SQL server. Yet, of all potential performance bottlenecks, disk I/O is often one of the most difficult to correct.<br><br>The two counters of initial focus are Avg Disk Sec/Read and Avg Disk Sec/Write. For good performance, disk reads/sec and disk writes/sec for the database disk as reported by Microsoft Windows System Monitor must be less than .010 for the database data files and less than .005 for the database log files. The following range is a standard typically used to evaluate disk read/sec and disk writes/sec: <ul style="list-style-type: none"> <li>• Very Good: &lt;0 .010</li> <li>• Adequate 0.010 - 0.020</li> <li>• Slow .020 - 0.050</li> <li>• Poor &gt;0 .050</li> </ul> |
| Network  | Generally has the fewest bottlenecks in a typical Local Area Network (LAN). This counter measures actual traffic, and thus there is not a "correct" number for this counter. To help decide whether the server(s) has a network bottleneck, initial analysis involved the following counters: <ul style="list-style-type: none"> <li>• Current Bandwidth – Available bandwidth for the network interface</li> <li>• Packets / Sec – Number of packets transferred per second</li> <li>• Bytes Total / Sec - Total number of bytes transferred per second</li> </ul>   |

# Performance/Functionality Tests

## Test #1: 8-hour Test

### Purpose

This initial test is used to execute the test load to identify and address any issues with the test cases as well as identify that the environment and application have been configured correctly for the workload. The goal of the test was to reach 40 concurrent users performing the tests that are outlined in the "Test Cases" section.

### Test Output: Test Case Success

The following table outlines the success rate of the test cases completed for Test #1:

| Total Test Cases | Successful Tests | Failed Tests | Tests/sec |
|------------------|------------------|--------------|-----------|
| 1703             | 1700             | 3            | .059      |

### Test Configuration and Results

The following data outlines the test configuration and results:

#### Test Cases

| Test Case | Business Process                  | Test Mix% | # of trx |
|-----------|-----------------------------------|-----------|----------|
| 1         | Create 2-Hour Service             | 37.50     | 641      |
| 2         | Create 30-minute Service          | 25.00     | 427      |
| 3         | Create 2-Hour Maintenance Service | 12.50     | 213      |
| 4         | Reschedule Existing Service       | 12.50     | 213      |
| 5         | Cancel Existing Service           | 12.50     | 213      |
| Total     |                                   | 100.00    | 1707     |

Transaction volume was calculated based on that each service scheduling site will be conducting 128 service activities per day for each of the 20 sites.

#### Assumptions:

For this test, service activity volume was assumed to be evenly distributed during the test duration.

#### Test Settings

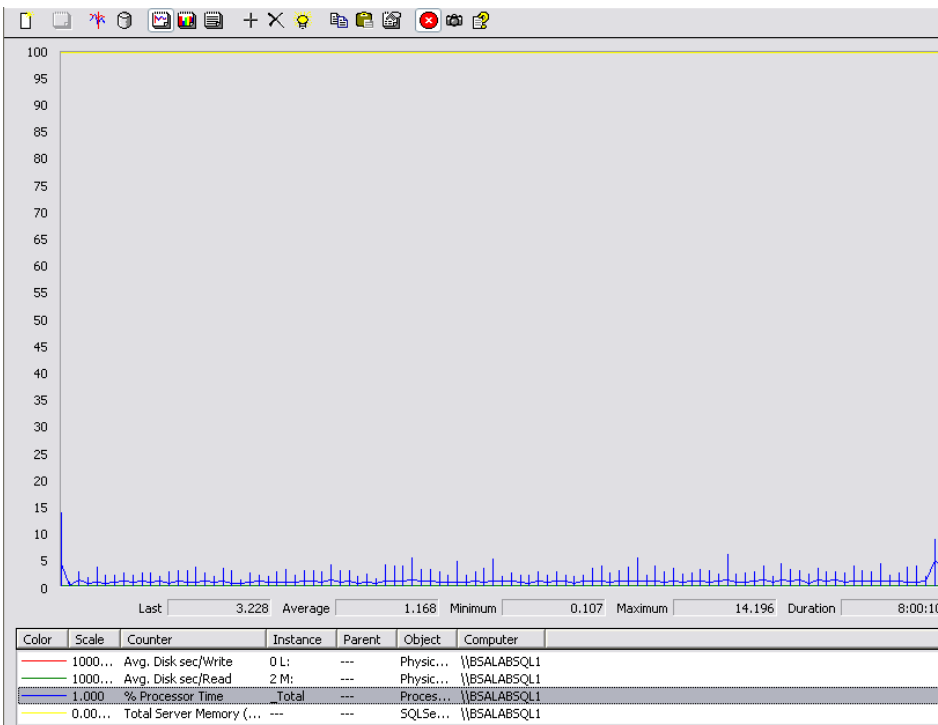
| Item                               | Value               |
|------------------------------------|---------------------|
| Run Duration                       | 8 hours             |
| Warm Up Duration                   | 60 Seconds          |
| Maximum Total User Count           | 40 Users            |
| Load Pattern                       | Step                |
| Time Profile                       | Normal Distribution |
| Think Time Between Test Iterations | 450 seconds*        |

**Note:** \*The 450 second think time was the least amount of time between iterations in our calculations and was representative of 40 users completing 2560 actions in one hour.

## Injector Settings

| Item                       | Value |
|----------------------------|-------|
| Number of Injectors        | 1     |
| Initial User Count         | 1     |
| Maximum Users per Injector | 40    |
| Step Duration (Seconds)    | 60    |
| Step User Count            | 10    |

## Test Output: Microsoft CRM SQL Server



## Processors

Average processor utilization during the load test on the computer running Microsoft SQL Server™ was 1.2% with a maximum of 14.1%. During the majority of the load test, processor activity on the computer running Microsoft SQL Server was not above 5%.

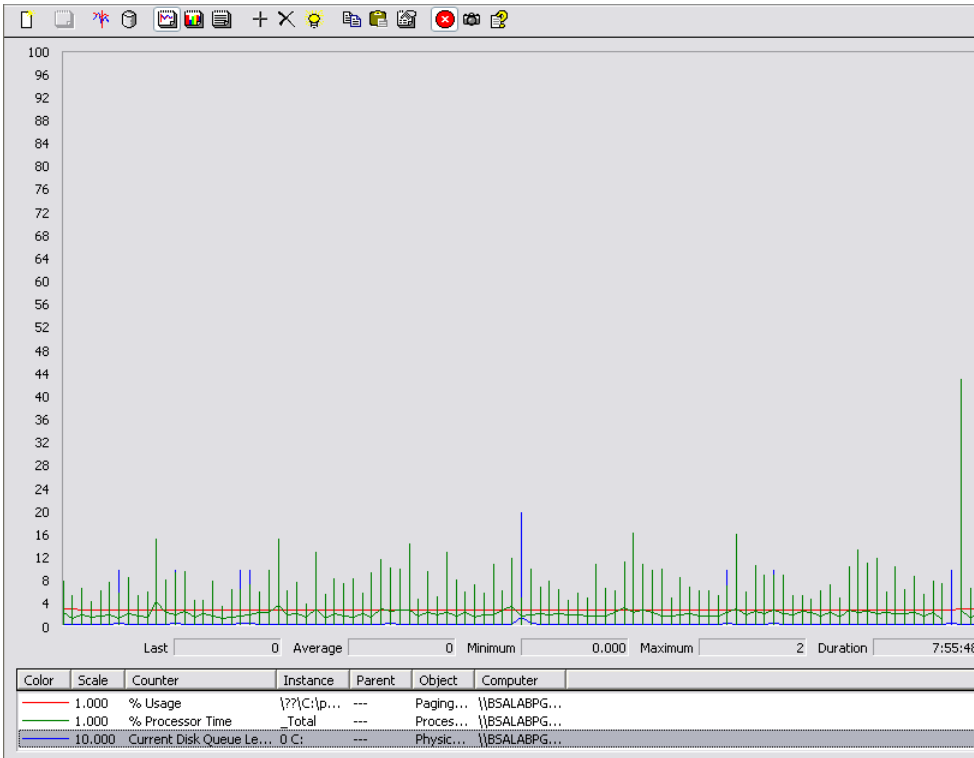
## Disks

- The Avg. Disk/sec Read counter on the drive where the database data files (.mdf) reside averaged 0 milliseconds during the load test with a maximum of 0 milliseconds.
- The Avg. Disk/sec Write counter on the drive where the database log files (.ldf) reside averaged 0 milliseconds during the load test with a maximum of 0 milliseconds.
- The Avg. Disk / sec Read and Avg. Disk/ sec Write counters were below the 10 millisecond threshold that we previously defined as “very good” performance. Therefore, disk I/O was not a concern during this test.

## Memory

Available Mbytes was well over the 10 MB threshold defined earlier. The load test did not cause any resource constraints on memory on the computer running Microsoft SQL Server.

## Test Output: Microsoft CRM Application Server



## Processors

The average processor utilization during the load test on the Microsoft CRM server was 2.1% with a maximum of 43.2%. During the majority of the load test, processor activity on the Microsoft CRM server was not above 10%.

## Disks

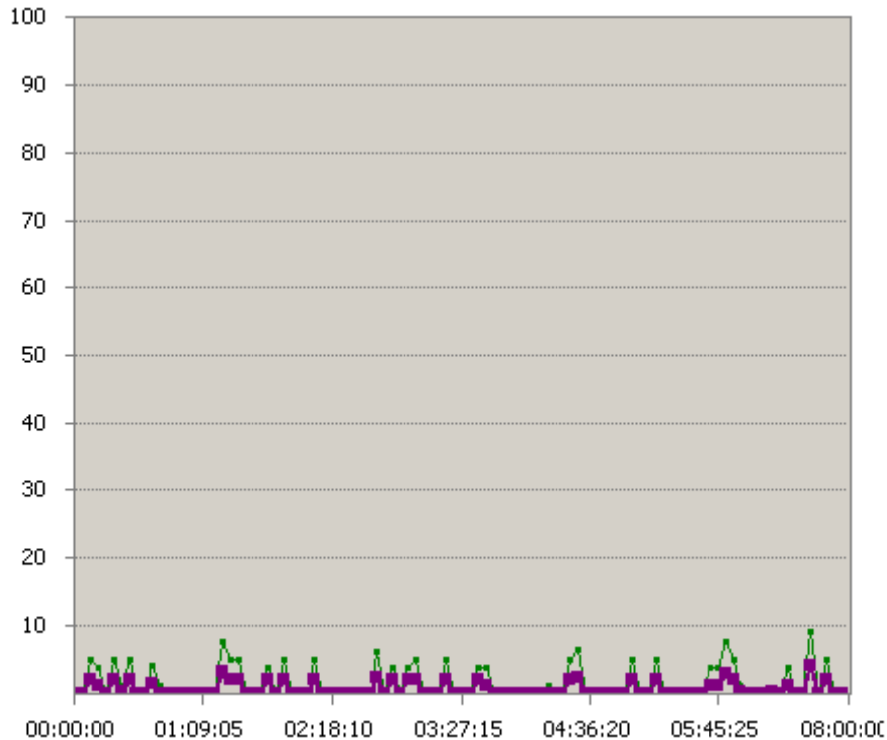
The Current Disk Queue Length counter on the Program Files drive averaged 0 waiting requests during the load test with a maximum of 2 waiting requests.

## Memory

The percent page file usage averaged 2.9% during the load test with a maximum of 3.1%. This low utilization of the page file does not indicate memory pressure on the Microsoft CRM server during this test.

## Network

The following graph measures the total number of bytes sent to and from the Microsoft CRM server during the load test. This counter is used to demonstrate the amount of network traffic that was generated between the Microsoft CRM server and the Microsoft CRM client.



| Counter            | Color | Range   | Min | Max     | Avg    |
|--------------------|-------|---------|-----|---------|--------|
| Bytes Received/sec | -     | 1000000 | 0   | 473,151 | 14,721 |
| Bytes Sent/sec     | -     | 1000000 | 0   | 224,055 | 6,004  |

The following table depicts the average number of seconds that was taken for each test case to run during the load test.

| Seconds | Test Case                                  |
|---------|--|
| .84     | cancelServiceActivityCoded                 |
| 1.77    | createNewServiceActivityThirtyMinutesASAP  |
| 1.91    | CreateNewServiceActivityTwoHourASAP        |
| 1.97    | createNewServiceActivityTwoHour_MonthLater |
| .66     | updateServiceActivity                      |

## Test #2: 12-hour test

### Purpose

This test is designed to run all the simulation test cases for 12 hours to simulate a workday. This test will be run for 12 hours to determine if there are any performance or scalability issues with the system under a load of 46 concurrent users simulating the defined transaction volumes.

### Test Output: Test Case Success

The following table outlines the success rate of the test cases completed for Test #2:

| Total Test Cases | Successful Tests | Failed Tests | Tests/sec |
|------------------|------------------|--------------|-----------|
| 2546             | 2539             | 7            | .059      |

### Test Configuration and Results

The following data outlines the test configuration and results:

#### Test Cases

| Test Case | Business Process                  | Test Mix% | # of trx |
|-----------|-----------------------------------|-----------|----------|
| 1         | Create 2-Hour Service             | 37.50     | 960      |
| 2         | Create 30-minute Service          | 25.00     | 640      |
| 3         | Create 2-Hour Maintenance Service | 12.50     | 320      |
| 4         | Reschedule Existing Service       | 12.50     | 320      |
| 5         | Cancel Existing Service           | 12.50     | 320      |
| Total     |                                   | 100.00    | 2560     |

Transaction volume reflects daily number of transactions for the entire organization (20 sites).

#### Assumptions

For this test, it was assumed that there was one dispatcher for every 12 field technicians and that the service activity volume was evenly distributed during the test duration.

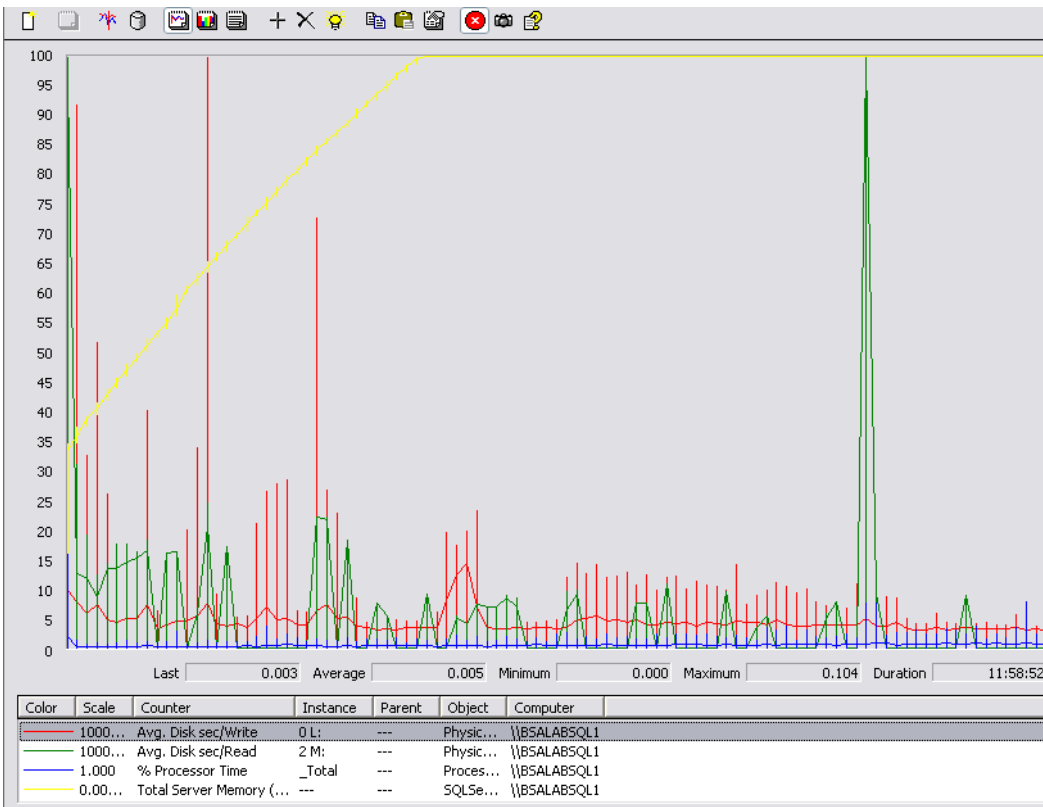
#### Test Settings

| Item                               | Value               |
|------------------------------------|---------------------|
| Run Duration                       | 12 hours            |
| Warm Up Duration                   | 60 Seconds          |
| Maximum Total User Count           | 46 users            |
| Load Pattern                       | Step                |
| Time Profile                       | Normal Distribution |
| Think Time Between Test Iterations | 680 Seconds         |

## Injector Settings

| Item                       | Value |
|----------------------------|-------|
| Number of Injectors        | 1     |
| Initial User Count         | 1     |
| Maximum Users per Injector | 46    |
| Step Duration (Seconds)    | 60    |
| Step User Count            | 10    |

## Test Output: Microsoft CRM SQL Server



## Processors

The average processor utilization during the load test on the computer running Microsoft SQL Server was .8% with a maximum of 25.6%. During the majority of the load test, processor activity on the computer running Microsoft SQL Server was not above 5%.

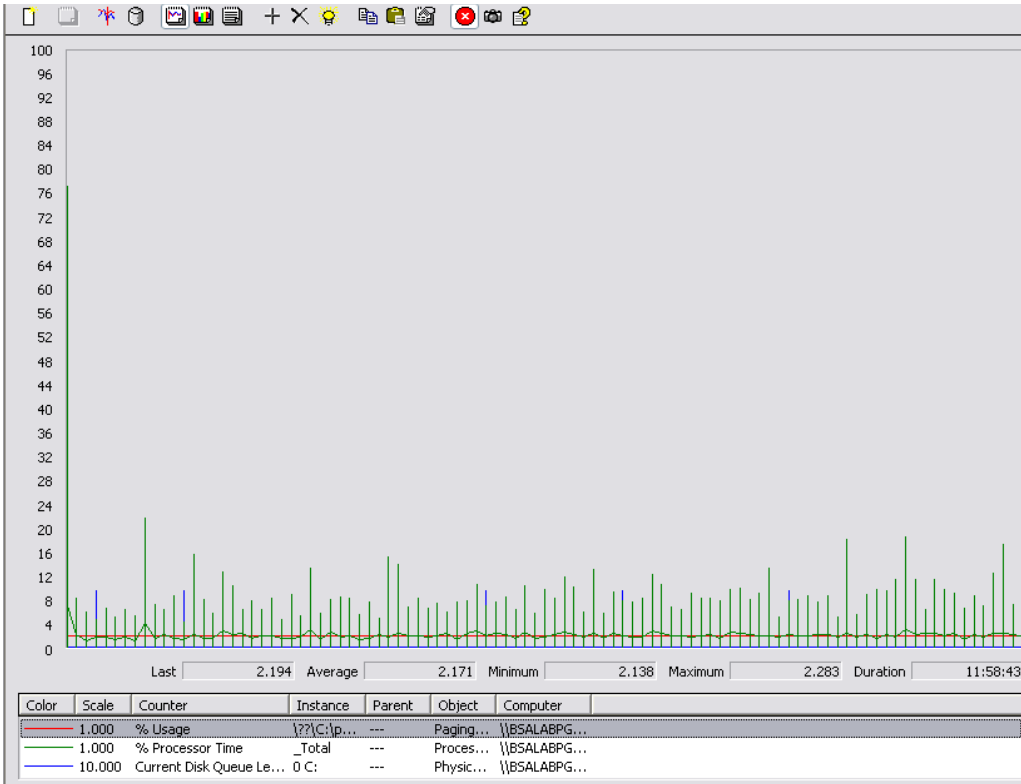
## Disks

- The Avg. Disk/sec Read counter on the drive where the database data files (.mdf) reside averaged 6 milliseconds during the load test with a maximum of 134 milliseconds.
- The Avg. Disk/sec Write counter on the drive where the database log files (.ldf) reside averaged 5 milliseconds during the load test with a maximum of 104 milliseconds.
- The Avg. Disk / sec Read and Avg. Disk/ sec Write counters were below the 10 millisecond “very good” performance threshold. Therefore, disk I/O was not a concern during this test. Spikes in the disk response time were identified to have been caused by nightly database backups and nightly database maintenance.

## Memory

Available Mbytes was well over the 10 MB threshold defined earlier. The load test did not cause any resource constraints on memory on the computer running Microsoft SQL Server.

## Test Output: Microsoft CRM Application Server



## Processors

The average processor utilization during the load test on the Microsoft CRM server was 2.3% with a maximum of 77.7%. During the majority of the load test, processor activity on the Microsoft CRM server was not above 10%.

## Disks

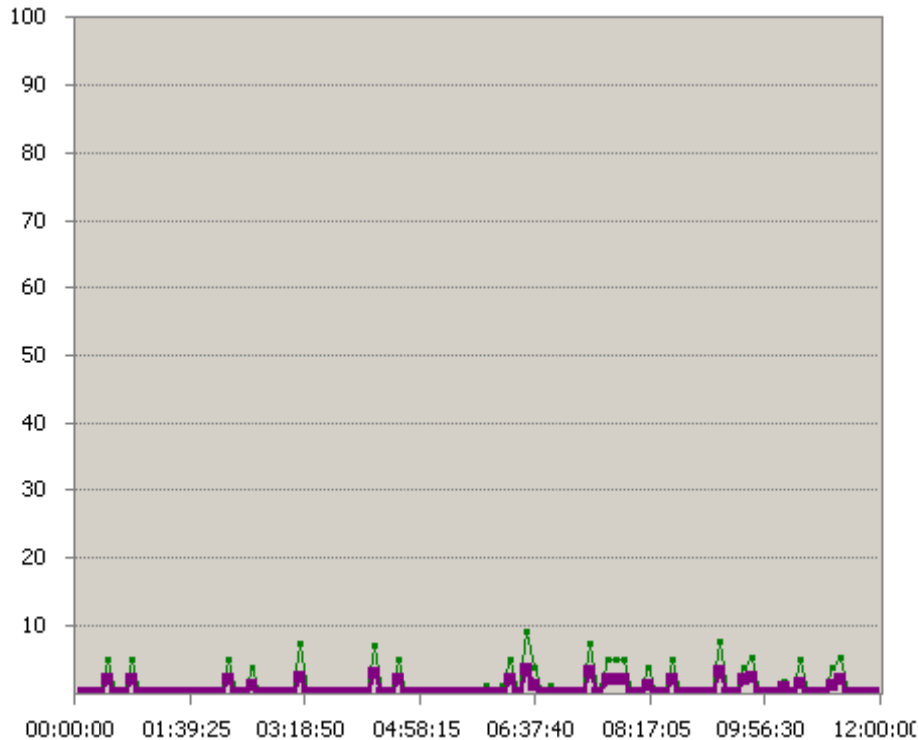
The Current Disk Queue Length counter on the Program Files drive averaged 0 waiting requests during the load test with a maximum of 1 waiting requests.

## Memory

The percent page file usage averaged 2.2% during the load test with a maximum of 2.3%. This low utilization of the page file does not indicate memory pressure on the Microsoft CRM server during this test.

## Network

The following graph measures the total number of bytes sent to and from the Microsoft CRM server during the load test. This counter is used to demonstrate the amount of network traffic that was generated between the Microsoft CRM server and the Microsoft CRM client.



| Counter            | Color | Range   | Min | Max     | Avg   |
|--------------------|-------|---------|-----|---------|-------|
| Bytes Received/sec | -     | 1000000 | 0   | 821,501 | 0     |
| Bytes Sent/sec     | -     | 1000000 | 0   | 361,163 | 6,021 |

The following table depicts the average number of seconds that was taken for each test case to run during the load test.

| Seconds | Test Case                                  |
|---------|--|
| .80     | cancelServiceActivityCoded                 |
| 1.55    | createNewServiceActivityThirtyMinutesASAP  |
| 1.90    | CreateNewServiceActivityTwoHourASAP        |
| 2.25    | createNewServiceActivityTwoHour_MonthLater |
| .55     | updateServiceActivity                      |

## Test #3: 40-Hour “Soak” Test Validation

### Purpose

This test is designed to simulate forty (40) consecutive hours of application usage under full load from 46 concurrent users simulating expected transaction volumes to determine any performance or scalability concerns with the system. The number of transactions simulated in this test should approximate the number of transactions expected over five (5), eight (8)-hour work days.

### Test Output: Test Case Success

The following table outlines the success rate of the test cases completed for Test #3:

| Total Test Cases | Successful Tests | Failed Tests | Tests/sec |
|------------------|------------------|--------------|-----------|
| 9741             | 9710             | 31           | .068      |

### Test Configuration and Results

The following data outlines the test configuration and results:

#### Test Cases

| Test Case | Business Process                  | Test Mix% | # of trx |
|-----------|-----------------------------------|-----------|----------|
| 1         | Create 2-Hour Service             | 37.50     | 3,750    |
| 2         | Create 30-minute Service          | 25.00     | 2,500    |
| 3         | Create 2-Hour Maintenance Service | 12.50     | 1,250    |
| 4         | Reschedule Existing Service       | 12.50     | 1,250    |
| 5         | Cancel Existing Service           | 12.50     | 1,250    |
| Total     |                                   | 100.00    | 10,000   |

Transaction volume is in terms of weekly number of transactions for the entire organization (20 sites).

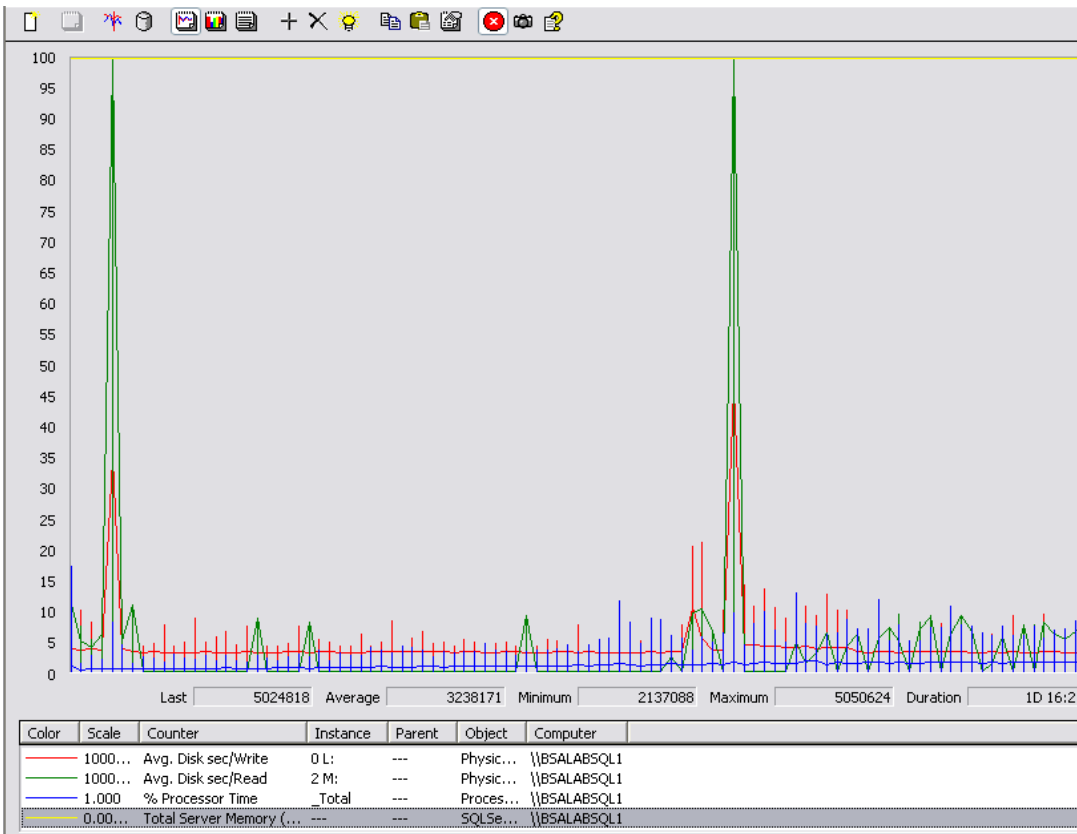
#### Test Settings

| Item                               | Value               |
|------------------------------------|---------------------|
| Run Duration                       | 40 hours            |
| Warm Up Duration                   | 60 Seconds          |
| Maximum Total User Count           | 46 users            |
| Load Pattern                       | Step                |
| Time Profile                       | Normal Distribution |
| Think Time Between Test Iterations | 680 Seconds         |

#### Injector Settings

| Item                       | Value |
|----------------------------|-------|
| Number of Injectors        | 1     |
| Initial User Count         | 1     |
| Maximum Users per Injector | 46    |
| Step Duration (Seconds)    | 60    |
| Step User Count            | 10    |

## Test Output: Microsoft CRM SQL Server



### Processors

The average processor utilization during the load test on the computer running Microsoft SQL Server was 1.3% with a maximum of 17.7%. During the majority of the load test, processor activity on the computer running Microsoft SQL Server was not above 5%.

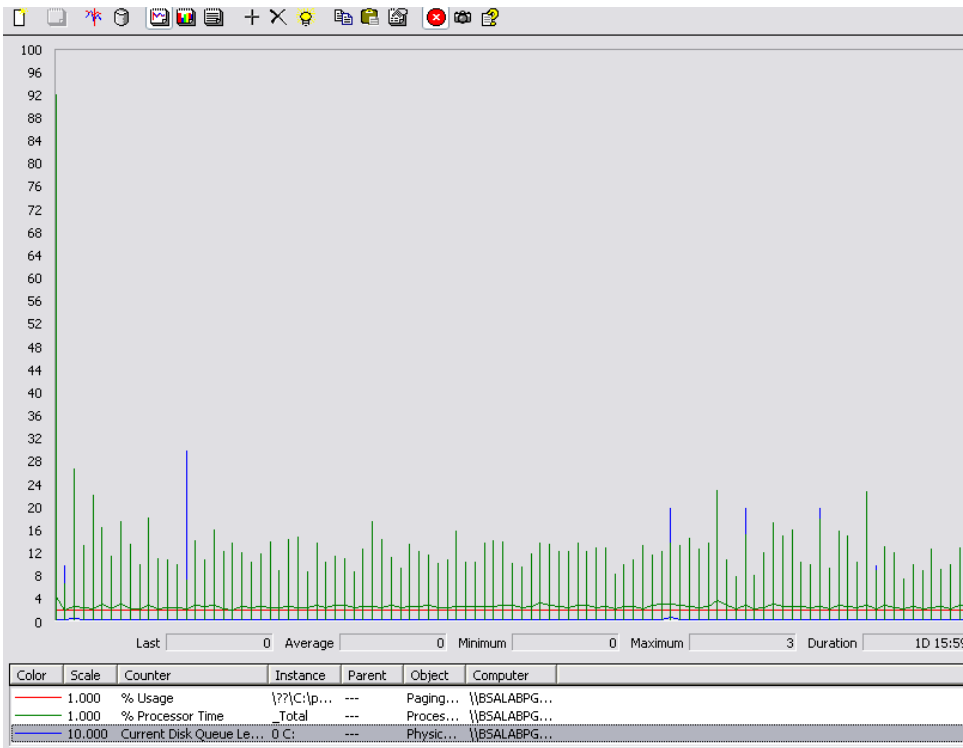
### Disks

- The Avg. Disk/sec Read counter on the drive where the database data files (.mdf) reside averaged 10 milliseconds during the load test with a maximum of 481 milliseconds.
- The Avg. Disk/sec Write counter on the drive where the database log files (.ldf) reside averaged 4 milliseconds during the load test with a maximum of 232 milliseconds.
- The average response times for the reads/writes per second during this test were below the industry standard of 10 milliseconds for “very good” performance. Spikes in disk response time were attributed to nightly database backups and nightly database maintenance.

### Memory

Available Mbytes was well over the 10 MB threshold defined earlier. The load test did not cause any resource constraints on memory on the computer running Microsoft SQL Server.

## Test Output: Microsoft CRM Application Server



### Processors

The average processor utilization during the load test on the Microsoft CRM server was 2.6% with a maximum of 92.6%. During the majority of the load test, processor activity on the Microsoft CRM server was not above 10%. The spike in processor utilization was noticed at the very beginning of the test during the warm up period for the load test.

### Disks

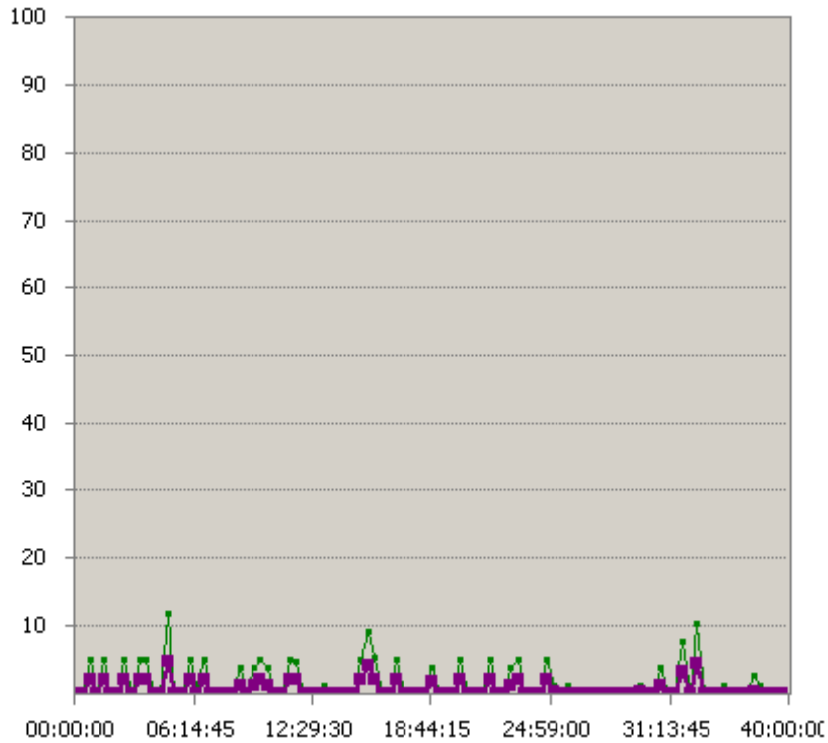
The Current Disk Queue Length counter on the Program Files drive averaged 0 waiting requests during the load test with a maximum of 3a waiting requests.

### Memory

The percent page file usage averaged 2% during the load test with a maximum of 2.1%. This low utilization of the page file does not indicate memory pressure on the Microsoft CRM server during this test.

## Network

The following graph measures the total number of bytes sent to and from the Microsoft CRM server during the load test. This counter is used to demonstrate the amount of network traffic that was generated between the Microsoft CRM server and the Microsoft CRM client.



| Counter            | Color | Range   | Min | Max     | Avg    |
|--------------------|-------|---------|-----|---------|--------|
| Bytes Received/sec | -     | 1000000 | 0   | 650,287 | 16,807 |
| Bytes Sent/sec     | -     | 1000000 | 0   | 326,661 | 6,845  |

The following table depicts the average number of seconds that was taken for each test case to run during the load test.

| Seconds | Test Case                                  |
|---------|--|
| .85     | cancelServiceActivityCoded                 |
| 3.8     | createNewServiceActivityThirtyMinutesASAP  |
| 2.7     | CreateNewServiceActivityTwoHourASAP        |
| 3.1     | createNewServiceActivityTwoHour_MonthLater |
| .65     | updateServiceActivity                      |

## Assumptions

The following assumptions were made during the test process:

- The CRM Product Team defined the test cases in this document at the time of the discovery.
- The performance testing process and test environment were limited to coverage of the:
- Test cases outlined in this document
- Areas and functions detailed in this document
- Infrastructure components (network accelerators, etc.) outlined in this document. Other components may have a positive or adverse affect system performance.

## Conclusions and Recommendations

Our testing demonstrated that a large, high performance service scheduling solution can be built on the CRM 3.0 application. The key behind successful implementation is to follow the best practices and optimization guidelines outlined by Microsoft®. We observed significant gains in performance by optimizing the deployment infrastructure and solution design based on the prescriptive guidance provided in the white paper *Service Scheduling: Optimizations and Considerations*.

The following conclusions were derived from the performance and scalability test of the Microsoft Dynamics CRM 3.0 Service Scheduling module:

- The test infrastructure handled the test load, as defined by the service scheduling scenario, within the industry standard ranges for performance.
- A single Microsoft Dynamics CRM 3.0 deployment, based on this performance test, can support the expected volumes and transaction activity defined in the test scenario.
- A single Microsoft CRM application server can handle the proposed load, based on this performance test and industry standards for performance.
- The specifications and configuration of the computer running Microsoft SQL Server handled the proposed load with little or no stress. Although the computer running Microsoft SQL Server had 32 GB of RAM in it, the test executions never used more than 8GB. The disk configuration also performed well under the load and would be appropriate for a production deployment with similar requirements.
- The Microsoft CRM test environment performed as expected under the test load and metrics and met industry standards for acceptable performance.

The following recommendations are proposed by the Microsoft BSA team:

- Follow the documented processes for implementing Microsoft CRM as outlined in the Microsoft CRM 3.0 Implementation Guide
- Work with the Microsoft CRM support team for any issues during the deployment of Microsoft Dynamics CRM 3.0 or for help with hot fixes or service packs
- If a similar scenario is deployed for a production customer, in an environment that is similar to the test environment used by Microsoft® (server specifications, disk configurations, etc), it is expected that performance will meet industry standards.

**Important:** The test cases, metrics and usage patterns contained in this document were defined by the CRM Product Team during the discovery phase of the testing process. Only the test scenarios and processes that are defined in this document were provided for testing and evaluated for performance. Scenarios or processes that are not defined in this document have not been tested with regard to performance. Microsoft cannot predict or guarantee how additional scenarios or processes may affect system performance.

# Appendix A: Environment Optimizations

## Microsoft SQL Server

The Microsoft SQL server was configured per preferred practices as defined in the Microsoft CRM 3.0 Implementation Guide. Most of the SQL server performance bottlenecks are because of incorrect disk configuration, because the disk is the slowest part of the SQL server. Following preferred practices, Microsoft configured the disks for the test environment as follows:

### External disk arrays

Microsoft CRM data (MDF) files were configured on a 12 disk RAID 1+0 set. This array was dedicated to only the SQL data files and these disks were not shared with any other applications. SQL Server TempDB was also placed on this array.

Microsoft CRM log (LDF) files were configured on a two (2) disk RAID 1 set. This array was dedicated to only the Microsoft CRM log files and these disks were not shared with any other applications.

Performance monitoring was completed by the Microsoft BSA team during the performance testing and given the usage patterns, database size, and user load, the Microsoft CRM databases did not need any additional indexes or configuration to perform at an optimal level.

### Snapshot Isolation

In SQL Server, snapshot isolation provides transaction-level read consistency. A data snapshot is taken when the snapshot transaction starts, and remains consistent for the duration of the transaction. Snapshot isolation is most beneficial when the probability is low that a transaction would have to be rolled back because of an update conflict.

The likelihood of two (2) users updating the same record, at the same time was highly unlikely during the load test, therefore to optimize concurrency during the load test, snapshot isolation was enabled on the Microsoft CRM database to support enhanced concurrency.

## Microsoft CRM Server

A single Microsoft Dynamics CRM 3.0 application server was used for the service scheduling scenario. The server was configured per preferred practices outlined in the Microsoft CRM 3.0 Implementation Guide.

Detailed configuration information for the CRM Application Server, including applied hot fixes, appears in Appendix F.

## Appendix B: Test Phase Configuration Details

### Lab Environment Setup

- Build vanilla Microsoft CRM test environment at Microsoft's lab facility in Fargo, ND (*the specific hardware configuration is detailed in a previous section of this document*)
- Configure Microsoft CRM databases for the service scheduling scenario in the test environment
- Apply latest security and application hot fixes
- Test environment configuration complete.

### Test Scripts

With the lab environment in place, the Microsoft BSA team will code into the system test scripts that mimic the service scheduling scenario activities. These test scripts are intended to simulate the load of adding users to the system, and the related activities of those users. The Microsoft BSA team will attempt to simulate the expected actions as close as possible given the current functionality of the testing toolkit.

### Load Test

- An appropriate load test mix of activities will be simulated for users in the Microsoft CRM system based on the data supplied to Microsoft.
- Run load tests for 40 and 46 users on test cases to provide a baseline for server and application performance given the testing parameters.
- After the completion of the tests to simulate one business day, the testing period will be expanded to 40 hours with a goal of simulating 46 concurrent scheduling users over a 40 hour period.

### Results

Provide benchmark data on the infrastructure requirements for the proposed application design for the full user, data and transaction volumes

## Appendix C: Web Tests used in Load Test

### Test 1: Create 2-Hour Service Activity ASAP

|                          |  |
|--------------------------|--|
| <b>Test Steps:</b>       | <ol style="list-style-type: none"><li>1. Select "Create New Service Activity"</li><li>2. Enter a Subject</li><li>3. Select a Service</li><li>4. Select a Site</li><li>5. Enter a Start Time and Date</li><li>6. Enter a End Time and Date</li><li>7. Click the "Schedule" button</li><li>8. Click the "Find Available Times" button</li><li>9. Select a resource from the list</li><li>10. Click "Save and Close"</li></ol>  |
| <b>Test Assumptions:</b> | <ul style="list-style-type: none"><li>▪ Used the date that the test was run for the service activity date</li><li>▪ Used the Quick Find instead of the Form Assistant</li><li>▪ Used the site that the user running the test belonged to</li><li>▪ Used the resource group that the user belonged to</li><li>▪ Used the most recent available date and time for the user at the time the test ran</li><li>▪ Selected the first listed resource returned by the scheduling engine</li></ul> |

### Test 2: Create 30-Minute Service Activity ASAP

|                          |   |
|--------------------------|---|
| <b>Test Steps:</b>       | <ol style="list-style-type: none"><li>1. Select "Create New Service Activity"</li><li>2. Enter a Subject</li><li>3. Select a Service</li><li>4. Select a Site</li><li>5. Enter a Start Time and Date</li><li>6. Enter a End Time and Date</li><li>7. Click the "Schedule" button</li><li>8. Click the "Find Available Times" button</li><li>9. Select a resource from the list</li><li>10. Click "Save and Close"</li></ol>   |
| <b>Test Assumptions:</b> | <ul style="list-style-type: none"><li>▪ Use the date that the test was run for the service activity date</li><li>▪ Used the Quick Find instead of the Form Assistant</li><li>▪ Used the site that the user running the test belonged to</li><li>▪ Used the resource group that the user belonged to</li><li>▪ Used the most recent available date and time for the user at the time the test ran</li><li>▪ Selected the first listed resource returned by the scheduling engine</li></ul> |

### Test 3: Create 2-Hour Service Activity Month Later

|                          |   |
|--------------------------|---|
| <b>Test Steps:</b>       | <ol style="list-style-type: none"> <li>1. Select "Create New Service Activity"</li> <li>2. Enter a Subject</li> <li>3. Select a Service</li> <li>4. Select a Site</li> <li>5. Enter a Start Time and Date</li> <li>6. Enter a End Time and Date</li> <li>7. Click the "Schedule" button</li> <li>8. Click the "Find Available Times" button</li> <li>9. Select a resource from the list</li> <li>10. Click "Save and Close"</li> </ol>    |
| <b>Test Assumptions:</b> | <ul style="list-style-type: none"> <li>▪ Used the Quick Find instead of the Form Assistant</li> <li>▪ Used the site that the user running the test belonged to</li> <li>▪ Used the resource group that the user belonged to</li> <li>▪ Used date and time one month after the most recent available time for the user at the time the test ran</li> <li>▪ Selected the first listed resource returned by the scheduling engine</li> </ul> |

### Test 4: Reschedule Service Activity

|                          |   |
|--------------------------|---|
| <b>Test Steps:</b>       | <ol style="list-style-type: none"> <li>1. Select Workplace</li> <li>2. Select Activities</li> <li>3. Select an Activity</li> <li>4. Change a Start Time and End Time</li> <li>5. Save and Close</li> </ol>        |
| <b>Test Assumptions:</b> | <ul style="list-style-type: none"> <li>▪ Selected to change the first service returned in the list</li> <li>▪ The new date used for the service activity is the original date of the test plus one day</li> </ul> |

### Test 5: Cancel Existing Request

|                         |   |
|-------------------------|---|
| <b>Test Steps:</b>      | <ol style="list-style-type: none"> <li>1. Select Workplace</li> <li>2. Select Activities</li> <li>3. Select an Activity</li> <li>4. Select Actions&gt;Delete Service Activity</li> <li>5. On the Confirm Deletion window, click OK</li> </ol> |
| <b>Test Assumption:</b> | <ul style="list-style-type: none"> <li>▪ Selected to change the first service returned in the list</li> </ul>   |

## Appendix D: Performance Monitor Counters

The following performance monitor counters were captured during the load testing:

| Object        | Counter                   | Description   |
|---------------|---------------------------|---|
| Physical Disk | Disk Reads/sec            | The rate of read operations on the disk.  |
| Physical Disk | Disk Writes/sec           | The rate of write operations on the disk.   |
| Physical Disk | Current Disk Queue Length | The number of requests outstanding on the disk at the time the performance data is collected. It also includes requests in service at the time of the collection. This is an instantaneous snapshot, not an average over the time interval. Multi-spindle disk devices can have multiple requests that are active at one time, but other concurrent requests are awaiting service. This counter might reflect a transitory high or low queue length, but if there is a sustained load on the disk drive, it is likely that this will be consistently high. Requests experience delays proportional to the length of this queue minus the number of spindles on the disks. For good performance, this difference should average less than two. |
| Physical Disk | Avg secs per read         | The average time, in seconds, of a read of data from the disk.  |
| Physical Disk | Avg secs per write        | The average time, in seconds, of a write of data to the disk.   |
| Memory        | Available MBytes          | The amount of physical memory available to processes running on the computer, in Megabytes, rather than bytes as reported in Memory\Available Bytes. It is calculated by adding the amount of space on the Zeroed, Free, and Stand by memory lists. Free memory is ready for use; Zeroed memory are pages of memory filled with zeros to prevent later processes from seeing data used by a previous process; Standby memory is memory removed from a process' working set (its physical memory) on route to disk, but is still available to be recalled. This counter displays the last observed value only; it is not an average.   |
| Paging File   | % Usage                   | The amount of the Page File instance in use in percent. See also Process\Page File Bytes.   |
| Processor     | Interrupts/sec            | The average rate, in incidents per second, at which the processor received and serviced hardware interrupts. It does not include deferred procedure calls (DPCs), which are counted separately. This value is an indirect indicator of the activity of devices that generate interrupts, such as the system clock, the mouse, disk drivers, data  |

|                    |                        |   |
|--------------------|------------------------|---|
| Processor          | %Processor Time        | The percentage of elapsed time that the processor spends to execute a non-Idle thread. It is calculated by measuring the duration of the idle thread is active in the sample interval, and subtracting that time from interval duration. (Each processor has an idle thread that consumes cycles when no other threads are ready to run). This counter is the primary indicator of processor activity, and displays the average percentage of busy time observed during the sample interval. It is calculated by monitoring the time that the service is inactive and subtracting that value from 100%. |
| Process            | %Processor Time        | The percentage of elapsed time that all of process threads used the processor to execution instructions. An instruction is the basic unit of execution in a computer, a thread is the object that executes instructions, and a process is the object created when a program is run. Code executed to handle some hardware interrupts and trap conditions are included in this count.  |
| System             | Processor Queue Length | The number of threads in the processor queue. Unlike the disk counters, this counter counters, this counter shows ready threads only, not threads that are running. There is a single queue for processor time even on computers with multiple processors. Therefore, if a computer has multiple processors, divide this value by the number of processors servicing the workload. A sustained processor queue of less than 10 threads per processor is normally acceptable, dependent of the workload.   |
| Redirector         | Bytes Total/sec        | The rate the Redirector is processing data bytes. This includes all application and file data in addition to protocol information such as packet headers.   |
| Redirector         | Network Errors/sec     | The rate at which serious unexpected errors are occurring. Such errors generally indicate that the Redirector and one or more Servers are having serious communication difficulties. For example an SMB (Server Manager Block) protocol error is a Network Error. An entry providing details is written to the System Event Log.  |
| Server             | Bytes Total/sec        | The number of bytes the server has sent to and received from the network. This value provides an overall indication of how busy the server is.  |
| Server             | Pool Paged Peak        | The maximum number of bytes of paged pool the server has had allocated. Indicates the proper sizes of the Page File(s) and physical memory.   |
| Server Work Queues | Queue Length           | The current length of the server work queue for this CPU. A sustained queue length greater than four might indicate processor congestion. This is an instantaneous count, not an average over time.   |

## Appendix E: Microsoft CRM Table Sizes

The following table shows the number of rows (records) in each Microsoft CRM table after completion of the 40 hour test (excluding tables with one hundred (100) or fewer rows):

| Table Name               | Rows  |
|--------------------------|-------|
| ActivityPartyBase        | 54159 |
| ActivityPointerBase      | 27081 |
| AttributeMapBase         | 655   |
| CalendarBase             | 1130  |
| CalendarRuleBase         | 1136  |
| DisplayStringBase        | 1085  |
| DisplayStringMapBase     | 1370  |
| InternalAddressBase      | 1164  |
| OrganizationUIBase       | 156   |
| PrincipalObjectAccess    | 28202 |
| PrivilegeBase            | 347   |
| PrivilegeObjectTypeCodes | 512   |
| QueueBase                | 1122  |
| QueueItemBase            | 27080 |
| ResourceBase             | 574   |
| resourceBase_bak         | 574   |
| RolePrivileges           | 3048  |
| RoleTemplatePrivileges   | 3048  |
| SavedQueryBase           | 396   |
| ServiceAppointmentBase   | 27080 |
| StatusMap                | 139   |

| Table Name           | Rows  |
|----------------------|-------|
| StringMap            | 1070  |
| StringMapBit         | 272   |
| sysallocunits        | 887   |
| syscolpars           | 11137 |
| syshobtcolumns       | 4360  |
| syshobts             | 771   |
| sysidxstats          | 1046  |
| sysiscols            | 1545  |
| sysmultiobjrefs      | 11916 |
| sysobjvalues         | 2036  |
| sysprivs             | 291   |
| sysrowsetcolumns     | 4360  |
| sysrowsets           | 771   |
| syssehobjs           | 1584  |
| syssefers            | 887   |
| syssingleobjrefs     | 1152  |
| SystemUserBase       | 563   |
| SystemUserPrincipals | 1683  |
| SystemUserRoles      | 561   |
| UserQueryBase        | 24684 |
| UserSettingsBase     | 561   |

# Appendix F: CRM Application Server Configuration

The following configuration data was collected from the Microsoft CRM server used for the performance testing.

## CRM Operating System Information

- Windows Server 2003 Enterprise Edition Service Pack 2
- CPU: AMD Opteron(tm) Processor 252
- Total RAM: 2048MB

## IIS related Information

### Authentication Method used on Microsoft CRM 3.0 Web Site

- Integrated Windows Authentication Method(s)

### Authentication Method used on MSCRMServices Virtual Directory

- Integrated Windows Authentication Method(s)

### "Microsoft CRM Services" Application Info

- MSCRMServices AppPool Id: CRMAppPool
- CRMAppPool is currently configured to run as: NetworkService

## List binding info for all web sites

### Web Site N°: 1

- Name/Comment: Default Web Site
- IP Address: (All Unassigned)
- Port Number: 80
- HostHeader: (No Host Header)

### Web Site N°: 2

- Name/Comment: Microsoft CRM v3.0
- IP Address: (All Unassigned)
- Port Number: 5555
- HostHeader: (No Host Header)

## List all Application Pool and their Identity

- *CRMAppPool* running as: *NetworkService*
- *DefaultAppPool* running as: *NetworkService*
- *SparcsAppPool* running as: *NetworkService*

## List of .Net Framework Versions installed on this machine:

- 1.1.4322.0 Valid (Root)
- C:\WINDOWS\Microsoft.NET\Framework\v1.1.4322\aspnet\_isapi.dll
- 2.0.50727.0 Valid
- C:\WINDOWS\Microsoft.NET\Framework\v2.0.50727\aspnet\_isapi.dll

## .Net Framework Version setup on each metabase entry:

- W3SVC/ 1.1.4322.0
- W3SVC/1/ROOT/Reports/ 2.0.50727.42
- W3SVC/1/ROOT/ReportServer/ 2.0.50727.42
- W3SVC/2/ROOT/ 1.1.4322.0
- W3SVC/2/ROOT/MSCRMServices/ 1.1.4322.0
- W3SVC/2/ROOT/SPARCS/ 2.0.50727.42

## CRM Services running account

- Microsoft CRM Workflow Service is running as: NT AUTHORITY\NETWORK SERVICE
- Microsoft CRM Deletion Service is running as: NT AUTHORITY\NETWORK SERVICE
- Microsoft CRM Bulk E-Mail Service is running as: NT AUTHORITY\NETWORK SERVICE

## CRM Hot fixes installed on the server

|          |          |          |          |
|----------|----------|----------|----------|
| KB894183 | KB913275 | KB915487 | KB917545 |
| KB909284 | KB913330 | KB915488 | KB917602 |
| KB910242 | KB913418 | KB915722 | KB917674 |
| KB910767 | KB913462 | KB915757 | KB917822 |
| KB910836 | KB913465 | KB915791 | KB917913 |
| KB911022 | KB913468 | KB915799 | KB918097 |
| KB911316 | KB913541 | KB915839 | KB918115 |
| KB911318 | KB913549 | KB915916 | KB918291 |
| KB911320 | KB913802 | KB916146 | KB918294 |
| KB911321 | KB913954 | KB916150 | KB918460 |
| KB911322 | KB914142 | KB916151 | KB918465 |
| KB911520 | KB914147 | KB916194 | KB918477 |
| KB911986 | KB914160 | KB916629 | KB918745 |
| KB912061 | KB914644 | KB916630 | KB918977 |
| KB912153 | KB914799 | KB916637 | KB918990 |
| KB912208 | KB915024 | KB916770 | KB919008 |
| KB912210 | KB915046 | KB917010 | KB919152 |
| KB912252 | KB915343 | KB917098 | KB919177 |
| KB912324 | KB915409 | KB917109 | KB919354 |
| KB912815 | KB915412 | KB917277 | KB919358 |
| KB913084 | KB915413 | KB917324 | KB919419 |
| KB913179 | KB915445 | KB917536 | KB919429 |

|          |          |          |          |
|----------|----------|----------|----------|
| KB919480 | KB924425 | KB927207 | KB929350 |
| KB920758 | KB924882 | KB927667 | KB929421 |
| KB920763 | KB925163 | KB927751 | KB929488 |
| KB920859 | KB925233 | KB927856 | KB929692 |
| KB921290 | KB925247 | KB927875 | KB929904 |
| KB921890 | KB925437 | KB928077 | KB930464 |
| KB922530 | KB925453 | KB928272 | KB930604 |
| KB922807 | KB925473 | KB928593 | KB930610 |
| KB922815 | KB925500 | KB928958 | KB931270 |
| KB923057 | KB925532 | KB929144 | KB931371 |
| KB923074 | KB925540 | KB929145 | KB931627 |
| KB924105 | KB926162 | KB929147 | KB931996 |
| KB924371 | KB927205 | KB929306 | KB932205 |

## General SQL Server Configuration Information

Running on the default instance of SQL Server (non-clustered)

- SQL Server language is English
- SQL Server Default Collation is: SQL\_Latin1\_General\_CP1\_CI\_AS
- SQL Server Version is SP2 (9.00.3042.00)

## General CRM Database Organization Information

CRM Organization Info:

- Organization Name.....: PG Case Study
- ReportingGroup Name.....: BSALAB\ReportingGroup
- SQLAccessGroup Name.....: BSALAB\SQLAccessGroup
- Number of Business Units.: 1
- Setup User.....: BSALAB\administrator

## Appendix G: Business Systems Architecture Team

The North America Microsoft Dynamics Business Systems Architecture Team provides prescriptive guidance on deployment infrastructure and hardware to Partners and Customers for Microsoft Dynamics deployments. Specific packaged services include Business Systems Architecture Assessments (includes hardware sizing), Health Checks, Microsoft CRM Performance Toolkit Proof of Concept (POC) engagements and Onsite System Performance Workshops.

Notice that these types of services are outside the scope of the Microsoft CRM Technical Presales Advisory Group (TPAG) resource (<https://partner.microsoft.com/global/40023009>).

For pricing information and availability, contact [MBSProfessionalServices@microsoft.com](mailto:MBSProfessionalServices@microsoft.com) today.

To learn more about the services that are provided by the Microsoft Dynamics Business Systems Architecture Team, visit PartnerSource at:

[https://mbs.microsoft.com/partnersource/resources/services/services/business\\_systems\\_architecture.htm](https://mbs.microsoft.com/partnersource/resources/services/services/business_systems_architecture.htm)