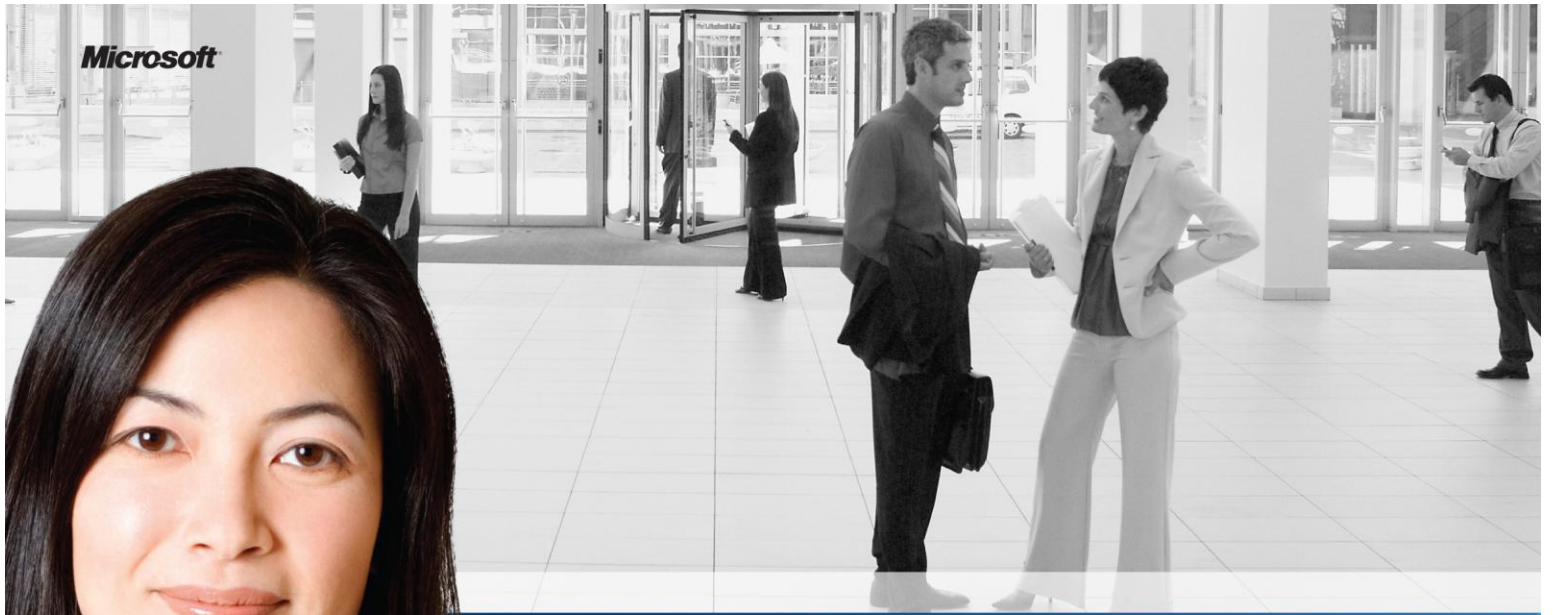


Microsoft



PERFORMANCE AND SCALABILITY

User Scalability for the
Enterprise

Microsoft Dynamics CRM 4.0

February 2008

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User Scalability for the Enterprise

Executive Summary

Microsoft Dynamics™ CRM business software is designed to help enterprises achieve a 360-degree view of their customers across marketing, sales, and service. Engineered to scale efficiently to the needs of the largest global deployments, Microsoft Dynamics CRM has been tested for user scalability, data scalability, and wide area network performance. This white paper focuses on user scalability.

Microsoft, together with Unisys Corporation, completed benchmark testing of Microsoft Dynamics CRM 4.0 running on Microsoft® Windows Server® 2008 operating system and Microsoft SQL Server® 2008 database software. Benchmark results demonstrate that Microsoft Dynamics CRM can scale to meet the needs of an enterprise-level, mission-critical workload of 24,000 concurrent users while maintaining performance at sub-second response times.

Test results were achieved without customizations to simulate an out-of-the-box Microsoft Dynamics CRM deployment. Standard optimization was applied using guidelines published in the Microsoft Dynamics CRM 4.0 Optimizing Performance toolkit. Extensive customer research formed the basis of the test design, test scenarios, database sizing, and record counts used in the testing.

These results reflect a snapshot of how Microsoft Dynamics CRM 4.0 performs in a specific environment.¹ Customers may be able to achieve higher levels of performance and scalability through customization and a finer level of optimization.

RESULTS SUMMARY

Microsoft Dynamics CRM 4.0, running on Microsoft Windows Server 2008 and Microsoft SQL Server 2008 was tested using Dell PowerEdge application servers and a single Unisys ES7000 database server. In this test environment, Microsoft Dynamics CRM demonstrated the following performance characteristics:

Table 1: Benchmark Test Results Summary

Concurrent Users	Average Response Time	Web Requests	Business Transactions	Average SQL Server Utilization	Average CRM Server Utilization
24,000	.70 seconds	1,051,921 / hr	169,344 / hr	61%	53%

¹ This benchmark shows scalability and performance for a particular implementation of Microsoft Dynamics CRM 4.0. Results will vary for each implementation.

MICROSOFT DYNAMICS CRM 4.0 SHOWED THE ABILITY TO SUPPORT 24,000 CONCURRENT USERS WITH SUB-SECOND RESPONSE TIMES.

THE BENCHMARK INCLUDED 169,000 BUSINESS TRANSACTIONS WITH OVER 1 MILLION WEB REQUESTS PER HOUR.

MICROSOFT
DYNAMICS CRM CAN
BE TUNED FOR
PERFORMANCE AND
SCALABILITY USING
STANDARD
MICROSOFT SQL
SERVER TOOLS AND
SKILL SETS.

THE MICROSOFT
DYNAMICS CRM 4.0
OPTIMIZING
PERFORMANCE WHITE
PAPER IS AVAILABLE
AS A FREE
DOWNLOAD FROM
MICROSOFT.

Overview

Microsoft Dynamics CRM 4.0 is designed to meet the stringent requirements of enterprise organizations in the areas of performance and scalability, application flexibility, and infrastructure manageability.

- **Performance and scalability:** Microsoft Dynamics CRM takes unique advantage of the Microsoft Windows and SQL Server platforms to provide enterprise levels of performance and scalability. The application is message-based and stateless, allowing for easy horizontal scaling through standard network load balancing methods. The application can be tuned for performance and scalability using common tools and skill sets, and is designed to maintain the benefits of tuning as the application changes.
- **Application flexibility:** Microsoft Dynamics CRM is engineered for change. Declarative configuration is quick and accessible through the user interface without coding or restarting servers. Customization is powerful and upgradeable through the Software Development Kit (SDK), and is based on industry standards such as Microsoft.NET, XML, and Web services.
- **Infrastructure manageability:** Microsoft Dynamics CRM is designed to improve application manageability through multiple deployment options and integration with enterprise systems management products such as Microsoft System Center Essentials. Multiple deployment models are available, including on-premise, hosted, and hybrid, and customers can change between deployment options seamlessly as their needs change. Built on the popular .NET platform, Microsoft Dynamics CRM takes advantage of existing investments in technology, infrastructure, and development skills many customers already have in place.

Testing Methodology

The benchmark testing was conducted by Microsoft in partnership with Unisys Corporation to demonstrate the performance and scalability characteristics of Microsoft Dynamics CRM 4.0 in conjunction with Microsoft Windows Server 2008 and Microsoft SQL Server 2008.

The generally available version of Microsoft Dynamics CRM 4.0 was used in all testing without customization to simulate an out-of-the-box deployment. Basic application tuning was performed using best practices outlined in the *Microsoft Dynamics CRM 4.0 Tuning and Optimization* white paper.

Test scenarios were created using the Microsoft Dynamics CRM 4.0 Performance and Stress Testing Toolkit based on extensive customer research. All test cases used for this benchmark are included in the Microsoft Dynamics CRM 4.0 Performance and Stress Testing Toolkit, and can be used by customers as a basis for their own benchmarking. This toolkit, available as a free download, is designed to help formalize performance testing of Microsoft Dynamics CRM by facilitating load testing in customer environments.

See the Resources section for links to the *Microsoft Dynamics CRM 4.0 Optimizing Performance white paper* and Microsoft Dynamics CRM 4.0 Performance and Stress Testing Toolkit.

BUSINESS TRANSACTIONS

Test scenarios were designed to approximate typical usage of Microsoft Dynamics CRM 4.0 by an enterprise-level sales organization based on extensive customer feedback. Simulated users performed common tasks including Create, Search, Update, and Delete for CRM entities such as accounts, contacts, and leads.

Each business transaction in the testing represented a user performing an end-to-end business process involving multiple interactions between the user and the system.

For example, the following activities comprise the *Create e-mail* business transaction:

1. Open the **Workplace** homepage.
2. Select **New** under Activities to create a new e-mail message.
3. Use **Find** to select the recipient from the user list.
4. Enter a subject and description.
5. Select an account from the list for the Regarding field.
6. Click **Save**.
7. Close the form.

TRANSACTION WORKLOAD

Forty-six unique business scenarios were tested to simulate a variety of enterprise roles and activities. The workload was created to simulate a high transaction CRM deployment exercising a broad range of CRM functionality. All 24,000 users were logged on rapidly in order to assess the impact of a large number of CRM users logging on to the system in a brief time period.

The workload executed resulted in over 169,000 complex business transactions, or over 1 million Web requests per hour for the 24,000 active concurrent users test. In a follow-the-sun global deployment, this translates to a projected average of over 4 million business transactions, or over 24 million Web requests in a 24 hour period.

See the Appendix for more information on the business scenarios selected for testing.

DATABASE SERVER

The benchmark testing was performed against a database with size and complexity similar to a real-world implementation of Microsoft Dynamics CRM 4.0. The test database contained over 60 million business records with a total size of 70GB. Microsoft SQL Server 2008 running on a Unisys ES7000 server demonstrated the ability to handle a significant load and scaled consistently as the load increased.

See the Appendix for detailed database information.

SCENARIOS USED FOR THIS TEST ARE PUBLISHED IN THE PERFORMANCE AND STRESS TESTING TOOLKIT, AVAILABLE AS A FREE DOWNLOAD FROM MICROSOFT.COM.

THE PERFORMANCE AND STRESS TESTING TOOLKIT ALLOWS YOU TO BUILD TEST SCENARIOS FOR YOUR ENVIRONMENT.

THE MICROSOFT
OPTIMIZATION
PERFORMANCE WHITE
PAPER CONTAINS
EXTENSIVE BEST
PRACTICES FOR
TUNING YOUR
MICROSOFT
DYNAMICS CRM
DEPLOYMENT.

TUNING AND OPTIMIZATION

In order to simulate an out-of-the-box deployment, no customizations were applied to the CRM application in the test environment. Standard optimization techniques were applied using guidelines from the *Microsoft Dynamics CRM 4.0 Optimizing Performance* white paper. Depending on the specific business processes involved, higher levels of performance and scalability may be possible through customization to meet specific business and performance requirements, and through deeper optimization.

See the Resources section of this paper for a link to the *Microsoft Dynamics 4.0 Optimizing Performance* white paper.

HARDWARE ENVIRONMENT

This section describes the hardware used in the test configuration, as well as the software installed on each system.

Table 2: Hardware Description

Test Component	Number	Hardware	Processor	Operating System	RAM	Software
Database Server	1	Unisys ES7000	16 socket, dual core Intel 3.4 GHz	Microsoft Windows Server 2008 Data Center x64 RCO	128 GB RAM	Microsoft SQL Server 2008 CTP5
Application Servers	6	Dell PowerEdge 2950	Single core, 3.0 GHz	Microsoft Windows Server 2008 Enterprise x64 RCO	8 GB RAM	Microsoft Dynamics CRM 4.0
Load Generation Servers	4	Dell PowerEdge 6950	Dual socket, dual core 2.8GHz	Windows Server 2003, Enterprise Edition, SP1	3 servers with 32 GB RAM; one server with 64 GB RAM	Microsoft Visual Studio 2005 Team Suite Microsoft CRM 4.0 Performance and Stress Testing Toolkit
Load Generation Servers	2	HP ProLiant DL 580	Dual socket, dual core 2.8 GHz	Windows Server 2003, Enterprise Edition, SP1	32 GB RAM	Microsoft Visual Studio 2005 Team Suite Microsoft CRM 4.0 Performance and Stress Testing Toolkit

The configuration used a F5 BIG-IP load balancer to distribute the traffic across the six Microsoft Dynamics CRM 4.0 servers. Microsoft SQL Server Reporting Services was placed on a separate tier, a common configuration in enterprise environments.

See the Appendix for detailed descriptions of the hardware.

Test Results

The results of the benchmark study validate that Microsoft Dynamics CRM 4.0 can scale to support 24,000 concurrent users in a single instance averaging sub-second response times. These results were achieved without customization and using basic performance tuning.

Using the same machine configurations, test cases and data volumes, the benchmark tests were executed against user groups of three sizes to demonstrate how the application performance was affected as it scaled.

The following table summarizes the performance of Microsoft Dynamics CRM 4.0 for user groups of three sizes:

Table 3: Summary of Scalability Results

Metric	6,000 Users	18,000 Users	24,000 Users
Average Response Time	0.21 seconds	0.29 seconds	0.70 seconds
Web Requests	468,000 / hr	812,160 / hr	1,051,920 / hr
Business Transactions	45,144 / hr	130,680 / hr	169,344 / hr
SQL Server CPU Utilization	20%	43%	61%
CRM Server CPU Utilization	5%	12%	53%

With 24,000 users, the application executed a projected transaction rate of 4,056,000 business transactions per day.

The test results were achieved with minimal tuning and optimization. Advanced tuning and optimization may deliver better user scalability.

THE TEST RESULTS WERE ACHIEVED WITHOUT CUSTOMIZATIONS AND WITH MINIMAL TUNING. ADVANCED TUNING AND OPTIMIZATION MAY DELIVER HIGHER USER SCALABILITY.

USE THE PROVIDED
TOOLS TO TEST AND
TUNE MICROSOFT
DYNAMICS CRM FOR
YOUR ENVIRONMENT.

Conclusion

Microsoft Dynamics CRM 4.0 demonstrated its ability to scale to support the needs of the largest global businesses. The benchmark testing showed that Microsoft Dynamics CRM 4.0, together with Microsoft Windows Server 2008 and Microsoft SQL Server 2008, scaled to support 24,000 users without customization and with minimal optimization. When projected to the usage patterns of a global enterprise, these results indicate that a Microsoft Dynamics CRM implementation is capable of supporting millions of requests per day.

The deep integration with key Microsoft business applications and components helps companies realize cost benefits by allowing them to take advantage of existing investments in technology, infrastructure, and resources to maintain and optimize the application. The flexible application architecture offers companies choices, including the deployment model that meets their needs and the user interface that is best for them.

The results achieved in this benchmark are reproducible through the use of the Microsoft Dynamics CRM 4.0 Performance and Stress Testing Toolkit along with the description of the testing provided in this paper.

Resources

Resources related to Microsoft Dynamics CRM 4.0 in the enterprise:

- [Microsoft Dynamics CRM Web Site](#)
- [Unisys Web Site](#)
- [Microsoft Dynamics CRM in the Enterprise brochure](#)
- [Microsoft Dynamics CRM Performance and Scalability Toolkit](#)
- [Microsoft Dynamics CRM Tuning and Optimization white paper](#)

Appendix A: Charts and Tables

Table 4: Benchmark Test Parameters Summary

Benchmark Test Parameters	
Concurrent Users Tested	24,000
CRM Business Transaction Rate	169,000/hour
CRM Web Request Rate	1,000,000/hour
Database Size	70 GB
CRM Application Servers (6 total)	Dell PowerEdge 2950, 4 socket dual core, 3.0 GHz, 8GB RAM
CRM Database Server	Unisys ES7000, 16 socket dual core, 3.4 GHz 128GB RAM

Table 5: Benchmark Results Summary

Key Benchmark Test Results	
Average Atomic Web Request resp. time	850 ms
Average CPU Utilization – CRM Servers	53%
Average CPU Utilization – SQL Server	61%

Table 6: Row counts for all tables with more than 100,000 rows at the completion of tests

Table	Total Rows
AccountBase	397542
ActivityPartyBase	18124302
ActivityPointerBase	6650708
AnnotationBase	3914338
AppointmentBase	386861
ContactBase	443336
CustomerAddressBase	1788551
EmailBase	1107812
EmailHashBase	450347
FaxBase	329982
IncidentBase	570970
InvoiceBase	211673
InvoiceDetailBase	330673
LeadAddressBase	941820
LeadBase	474358
LetterBase	329907
OpportunityBase	1224897
OpportunityCloseBase	622581
OpportunityProductBase	1250828
OrderCloseBase	427812
PhoneCallBase	383949

PrincipalObjectAccess	8335641
QueueItemBase	3194205
QuoteBase	1251405
QuoteCloseBase	791781
QuoteDetailBase	854974
SalesOrderBase	644633
SalesOrderDetailBase	262867
TaskBase	2237054
UserQueryBase	1427188

Table 7: Database Server Hardware

Database Server Hardware	
Manufacturer	Unisys
Model	ES7000
Operating System	Windows Server 2008 DataCenter x64 RC0
Processor	16 socket, dual core Intel 3.4 GHz
Network Adapter	1 GB NIC
RAM	128 GB
Software	SQL Server 2008 CTP5
SAN	16 Spindles:
Data	200 GB RAID 1+0
Log	400 GB RAID 1+0
TempDb	190 GB RAID 1+0

Table 8: Load Balancer Hardware

Load Balancer	
Manufacturer	F5
Model	BIG-IP
Balancing algorithm	Ratio

Table 9: Application Server Web Farm Hardware

The application server Web farm consisted of 6 computers, configured as shown below:

Application Server	
Manufacturer	Dell
Model	PowerEdge 2950
Operating System	Windows Server 2008 Enterprise x64 RC0
Processor	Single core, 3.0 GHz
Network Adapter	1 GB NIC
RAM	8 GB
Software	Microsoft Dynamics CRM 4.0

Table 10: Load Generation Server Hardware

Six load generation servers were used; four of the servers were configured as shown below:

Application Server	
Number of servers	4
Manufacturer	Dell
Model	PowerEdge 6950
Operating System	Windows Server 2003, Enterprise Edition, SP1
Processor	Dual socket dual core 2.8 GHz
Network Adapter	1 GB NIC
RAM	Three servers with 32 GB; one server had 64 GB
Software	Visual Studio 2005 Team Suite

Table 11: Load Generation Server Hardware

Two of the load generation servers were configured as shown below:

Application Server	
Number of servers	2
Manufacturer	HP
Model	ProLiant DL580
Operating System	Windows Server 2003, Enterprise Edition, SP1
Processor	Dual socket dual core 3.4 GHz
Network Adapter	1 GB NIC
RAM	32 GB
Software	Visual Studio 2005 Team Suite

Table 12: Business cases selected for testing

AccountActivityRollup	CreateEmail	DeleteNoteOnLead
AccountOppRollup	CreateNewAccount	DeleteNoteOnOpportunity
AccountSCRollup	CreateNewContact	DeleteNoteOnTask
AddActivityToAccount	CreateNewLead	DeleteOpportunity
AddActivityToLead	CreateNewNoteForAccount	DeleteTask
AdvancedFindAccount	CreateNewNoteForContact	EmailQuote
AdvancedFindAccountNotes	CreateNewNoteForLead	FindAccounts
AdvancedFindContact	CreateNewNoteForOpp	FindContacts
AdvancedFindProduct	CreateNewNoteForTask	QuickCreateNewAccount
AssignAccounts	CreateNewOpportunity	ShareAccounts
AssignContact	CreateQuote	UpdateAccount
AssignLead	CreateServiceCaseAccount	UpdateContact
AssignOpportunity	CreateTask	UpdateLead
AssignServiceCase	DeleteLead	UpdateOpportunity
ConvertleadToOpp	DeleteNoteOnAccount	UpdateTask
WithAccount	DeleteNoteOnContact	

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