



Intentia IBM @server iSeries Benchmark Report

*IBM @server iSeries System Performance Team
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Table of Contents

Introduction	3
System Configurations	5
Intentia Software	7
Database	8
Business Flow	9
Benchmark Methodology	11
Results	13
<i>IBM @server i5 570</i>	14
<i>IBM @server i5 825</i>	15
<i>CPU Utilization</i>	15
Scalability Results	16
<i>IBM @server i5 570 1-way</i>	17
<i>IBM @server i5 570 2-way</i>	18
<i>IBM @server i5 570 4-way</i>	18
Summary	19
Other Notes	19

Introduction

For many years, thousands of Intenia customers have relied on IBM @server® iSeries™ servers to be reliable, high-performance servers at the core of their business operations. Building on this foundation, the introduction of POWER5™ processor-based IBM @server i5 servers—the latest members of the iSeries family—takes performance to the next level.

Intenia is one of the world's leading suppliers of collaboration software, with approximately 3,000 employees who serve more than 3,400 customers in the manufacturing, maintenance and distribution industries via a worldwide network spanning 40 countries. The Intenia Movex enterprise resource planning (ERP) solution is a leading Java™ program-based application, which runs primarily on iSeries servers. Complementary front-end applications—Movex Workplace and Movex Net Extension—were added to the IBM WebSphere® Application Server foundation to extend collaboration to the Web. These complementary applications, which previously ran only on Microsoft® Windows® platforms, are now available on the IBM i5/OS™ operating system—the latest generation of the OS/400® operating system, designed for the @server i5 server. Thus, Intenia customers can now take advantage of iSeries reliability and performance for these front-end applications in addition to the Movex Business Engine back end. Because iSeries servers were designed to run multiple applications simultaneously, all three of these Intenia Movex applications can run on the same server, resulting in a simpler configuration and improved response time compared to a multiple-server setup.

To demonstrate the ability to run these three applications simultaneously, the test team used tools to simulate users entering orders through Movex Workplace and Movex Net Extension into Movex Business Engine, including full back-end processing to invoice the orders. The test team then ran these applications on both a three-processor IBM @server iSeries 825-2473 running the OS/400 V5R2 operating system and a single-processor IBM @server i5 570-0919 running the i5/OS V5R3 operating system.

Both servers achieved excellent results, including subsecond response times and nearly 1,000 order lines processed per minute. Despite the fact that the iSeries 825 had three times as many processors and a 9 percent higher Commercial Processing Workload (CPW) rating, the model 570 was able to process nearly the same number of orders per hour as the iSeries 825.

The advantages of the model 570 were further demonstrated by showing the scalability running the same applications with one, two and four processors. The four-processor server was able to process more than 4,000 order lines per minute, demonstrating the capability of the model 570 to handle increased application demands as a business grows.

The Intenia benchmark is a demonstration of the unique capabilities of the iSeries platform:

- *IBM POWER5 technology with its superior scaling and integration demonstrates that processor clock speed is not everything.*
- *These servers can run multiple complex workloads even on a single-processor system.*
- *The integration strength of i5/OS, DB2 Universal Database™ (UDB) for iSeries, Java and the WebSphere Application Server demonstrates the capability of iSeries servers to support new application models.*
- *The consolidation and integration of a leading independent software vendor (ISV) solution from a server farm to a single server provides strong advantages for small and medium-sized businesses. A single @server i5 server can be used for both back-end and front-end applications to replace a group of heterogeneous servers, with significant price/performance and total cost of ownership (TCO) gains over previous-generation technology.*

System Configurations

To gauge the performance of Intenia software on two iSeries servers—the iSeries 825 and the @server i5 570—the IBM test team configured a partition on each server with the following resources:

	iSeries 825-2473	@server i5 570-0919
Active processors:	Three	One
CPW rating:	3,600	3,300
Main storage:	7248MB	7248MB
Disk:	10 arms, 15k rpm, 35GB capacity each	10 arms, 15k rpm, 35GB capacity each
Disk configuration:	Single auxiliary storage pool (ASP) with RAID-5 device parity protection	Single ASP with RAID-5 device parity protection
Disk I/O processor (IOP):	All disks connected to one 2757 IOP	Disks spread across one 5709 IOP and one 2757 IOP
Network:	100Mbps Ethernet, full duplex	100Mbps Ethernet, full duplex
Operating system:	OS/400 V5R2	i5/OS V5R3

In the scalability tests, slightly different configurations of the model 570 server were used. Each of the three model 570 servers used a different number of processors and amount of main storage (see Table 1). The three servers used an identical configuration for disk, network, operating system and applications. Note that the disk configuration was not minimized for these tests—it may be possible to achieve similar performance with fewer disk arms, especially for the 1-way and 2-way configurations. The scalability tests used a different application configuration than the one used in the iSeries 825 and model 570 comparison, which accounts for differences in the required main storage and in the results.

	1-way Server	2-way Server	4-way Server
Model	@server i5 570-0919	@server i5 570-0920	@server i5 570-0920
Active processors	1	2	4
CPW rating	3,300	6,000	11,700
Main storage	8GB	10GB	13GB
Disk	18 arms, 15k rpm, 35GB capacity each		
Disk configuration	Two ASPs with RAID-5 device parity protection: the Movex Business Engine database and Movex Output directory were stored on the second ASP; all other data used the first ASP		
Disk IOP	Six disks in ASP 1 using one 5709 IOP; twelve disks in ASP 2 using one 2757 IOP		
Network	100Mbps Ethernet, full duplex		
Operating system	i5/OS V5R3		

Table 1 - Configurations for iSeries servers used in scalability testing

All system configurations used security level 40 to help simulate a real-world implementation.

Intentia Software

The benchmark test described in this white paper used the latest versions of three Intentia products:

Movex Business Engine 12.4.3 SP12 – Business Engine provides the foundation for Intentia’s business software. It provides a flexible framework for managing business processes and allows organizations to customize the Intentia solution to meet business needs. Although Movex Business Engine has its roots in the OS/400 and RPG platforms, the current version is built with Java technology, providing additional flexibility and a solid platform for the future.

Movex Workplace 5.1 – Movex Workplace is a role-based user interface that combines portal and Web technology with predefined work flows. These predefined work flows can be modified and combined with company-specific components and work flows. Movex Workplace provides employees with fast, easy access to work-related information and applications, thereby helping increase their productivity and efficiency. Workplace is built on top of IBM WebSphere Application Server V5.1.

Movex Net Extension 5.1 – Movex Net Extension is a state-of-the-art interface to all the powerful collaboration applications that comprise Movex. It is a thin client built to run as a component of Movex Workplace. Because it is based on open standards, it can easily be integrated with other systems and solutions as well as being fully adaptable to new platforms and technologies that are likely to emerge in the future. Net Extension also runs on IBM WebSphere Application Server V5.1.

Previous versions of Workplace and Net Extension were supported only on Microsoft Windows operating systems. Now that iSeries servers are also supported, customers can run all three products on a single iSeries server. The result is a more reliable server that can be simpler to manage. Response time may also be improved because of the reduced time for communicating between Net Extension and Business Engine.

Database

The IBM test team configured the Movex Business Engine database with the following data:

- *Customers: 200,000 (OCUSMA table)*
- *Items: 100,000 (MITMAS table)*
- *Customer locations: 2,000*

This database contained 2,978 physical files and 7,716 logical files; the total size of the database library (not including journals and journal receivers) was 5.8GB at the beginning of the run. In the scalability tests, the database library grew to 8.7GB on the 1-way, 11.0GB on the 2-way and 15.6GB on the 4-way by the end of the run.

The test Movex Workplace database was created with the standard Workplace installation program and then populated with 2,001 additional users. During the benchmark runs, each virtual user logged in as one of these users. The Workplace tree was populated with Movex programs by importing the MOVEX_DEMO_GB.xml file included in the Workplace installation.

The Workplace database contained 33 tables, 15 indexes and 302 stored procedures. The total size of the database library was 59MB at the beginning of the run. The Workplace database did not grow significantly over the course of the runs.

Business Flow

The IBM test team used a load-generation tool to simulate users accessing Movex Workplace through a Web browser. Each user logged in to Workplace and then entered a series of orders through Movex Net Extension, which was connected to Movex Business Engine on the same server. Each order consisted of five order lines. At the end of the run, each virtual user logged out.

Workplace and Net Extension were running inside a single instance of WebSphere Application Server V5.1. Users connected to an Apache server running on the same server, which then passed the requests to WebSphere.

The test team configured Movex Business Engine to fully process each order after it was entered, including the following steps:

- *Checking agreements*
- *Checking item aliases*
- *Checking buying groups*
- *Checking order charges*
- *Checking assortments*
- *Automatically connecting shipments*
- *Automatically selecting routes*
- *Automatically selecting loading docks*
- *Looking up prices through multiple levels*

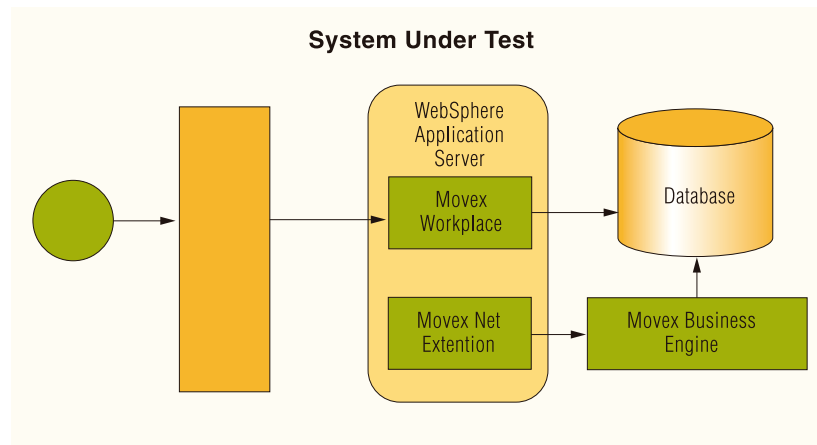


Figure 1. Major system components in iSeries Intertia benchmark test

The Movex AutoJobs perform all of these steps through background batch processing; therefore, users do not have to wait for these steps to complete before continuing with the next order. The test team tuned the Movex AutoJobs so that they completed processing orders at about the same rate that new orders were entered. This tuning helped ensure that the measured throughput could be maintained over an extended period of time. Because the AutoJobs ran in the background, the system could handle periods of higher peak utilization; during such periods, the AutoJobs would temporarily fall behind but would be able to catch up later during periods of lower utilization.

Figure 1 shows an overview of the major system components involved in the test.

Benchmark Methodology

The IBM test team configured the load-generation tool to simulate a small number of virtual users entering orders at a fast rate. Each user was configured to enter 900 orders during the run. To maximize throughput, a series of practice runs were made on each server to choose the optimal number of users for that server.

After logging in, the user performed an order-entry operation consisting of seven steps:

1. Create a new order
2. Enter order line 1
3. Enter order line 2
4. Enter order line 3
5. Enter order line 4
6. Enter order line 5
7. Close the order

With real users, each of these steps would require the user to wait for the browser to render the page, then decide what to do next and provide some input in the browser window (such as typing an item number or clicking a button) to begin the next step. In the benchmark environment, these activities were simulated with a delay between each step, commonly called the *think time*. It is a typical practice in benchmarks to use a small number of virtual users with a short think time to represent a larger number of real users with a longer think time because this reduces the amount of infrastructure and effort required to run the benchmark while retaining most of the same performance characteristics.

In this benchmark, the virtual users were configured with an average think time of 1 second, so that each complete order had a think time of about 7 seconds in addition to the server's response time. In a live environment, real users would typically have a much longer think time, so the server would be able to handle a larger number of real users. For example, if a real user took 5 seconds to enter each order line and 15 seconds between orders, the total think time for an order would be closer to 35 seconds. In this case, the system might be able to handle 5 times as many real users as the number of virtual users used in the benchmark. The actual think time for real users could vary widely from one customer to another, at different times of day, or even from one individual user to another.

Because full order processing consists of both an interactive and a batch component, the primary metric for this benchmark is *number of invoiced order lines per hour*, rather than the number of order lines entered per hour. An invoiced order line has completed all of the interactive and batch processing required for that order. To measure the number of invoiced order lines, the OOLINE table in the Movex database was monitored for order lines with a status of "77," indicating that processing was complete for that line.

The number of invoiced order lines was counted once every minute throughout the benchmark test. Once the run was complete, the number of invoiced order lines per hour over a particular measurement interval was calculated from this data. In the tests comparing the @server i5 570 with the iSeries 825, the measurement interval was defined to be the time required to enter 100,000 order lines. This includes the ramp-up period at the very beginning of the run, which tends to have lower throughput. This definition is useful when comparing relatively small systems, because the ramp-up period is fairly short. In the scalability tests, the measurement interval was defined to be a 90-minute period beginning 15 minutes after the run started. This definition gives a more accurate view of the relative performance when comparing systems with significantly different performance characteristics, because the ramp-up period for each configuration will be somewhat different, making comparisons difficult.

To demonstrate that the results were repeatable, each result consisted of two runs with identical parameters.

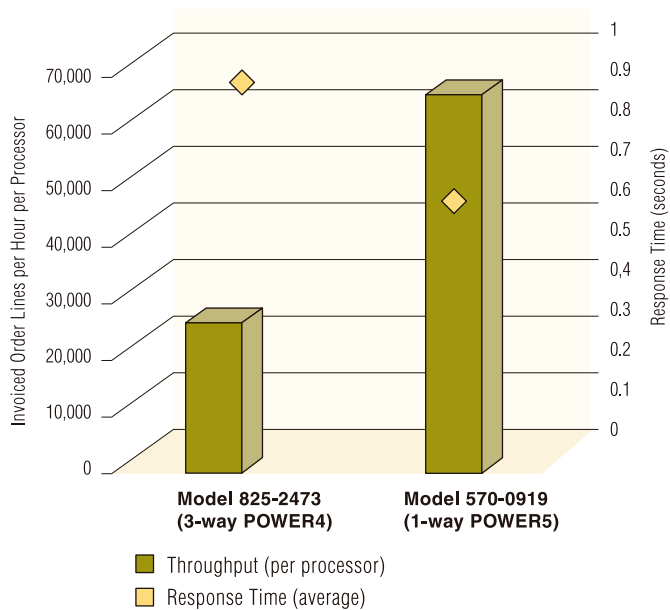


Figure 2. POWER4™ versus POWER5 processors: performance comparison

Results

The results of the Intenia benchmark test showed that the two iSeries servers both performed well (see Figure 2). The @server i5 570 achieved faster response times even though it used two fewer processors than the iSeries 825.

IBM @server i5 570

The model 570 invoiced 57,293 order lines per hour in one run and 57,592 order lines per hour in the second run. In both runs, 25 virtual users were used.

Response time – Table 2 shows the average response time for each Web browser transaction on the model 570. Response times do not include the average one-second think time for each transaction, and they measure the entire length of the run, not just the 100,000 order line measurement interval.

Step	Number per Order	Average Response Time (Seconds)		90 th Percentile Response Time (Seconds)	
		Run 1	Run 2	Run 1	Run 2
Create Order Head	1	0.124	0.132	0.160	0.170
Insert Order Line	5	0.073	0.077	0.089	0.099
Close Order	1	0.061	0.063	0.099	0.099

Table 2 - Average response times for the @server i5 570

IBM @server i5 825

The iSeries 825 invoiced 58,658 order lines per hour in the first run and 58,981 order lines per hour in the second run. In both runs, 26 virtual users were used.

Response time – Table 3 shows the average response time for each Web browser transaction on the iSeries 825. Response times do not include the average one-second think time for each transaction, and they measure the entire length of the test run, not just the 100,000 order line measurement interval.

Step	Number per Order	Average Response Time (Seconds)		90 th Percentile Response Time (Seconds)	
		Run 1	Run 2	Run 1	Run 2
Create Order Head	1	0.189	0.209	0.382	0.403
Insert Order Line	5	0.107	0.123	0.301	0.322
Close Order	1	0.091	0.100	0.281	0.291

Table 3 – Average response times for the iSeries 825

CPU Utilization

On both servers, the CPU experienced 90 to 100 percent utilization for most of the test.

The following is an approximate CPU breakdown for the model 570:

- *Movex AutoJobs processing: 56 percent*
- *Movex interactive processing: 32 percent*
- *Movex Workplace: 7 percent*
- *HTTP server: 2 percent*

The remaining CPU resources were consumed by miscellaneous system tasks. The CPU breakdown was similar on the iSeries 825.

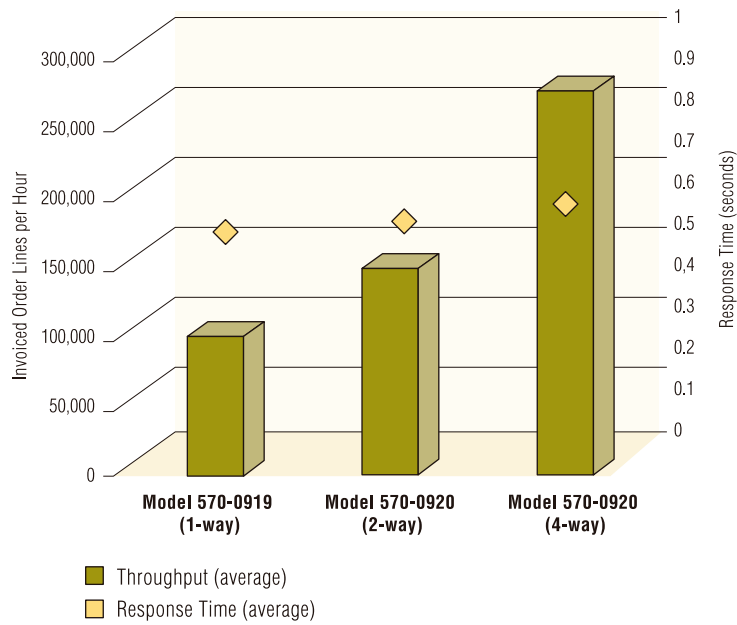


Figure 3. Intenia iSeries scalability

Scalability Results

In the scalability tests, the @server i5 570 exhibited excellent scalability as processors were added, demonstrating this server's capability to grow along with a business. Throughput increased dramatically with each additional processor, and response time remained excellent for each of the configurations tested (see Figure 3).

The scalability tests used a different configuration of Movex Business Engine than the iSeries 825 and model 570 comparison. This configuration change is typical for Intenia's larger customers and was necessary to handle the large transaction volumes supported by the 4-way model 570. In addition, more attention had to be given to the disk configuration so that the system could handle the increased volume efficiently. Finally, the measurement interval definition was altered to provide a more accurate comparison among servers with significantly different performance capabilities. The combined effect of these changes was an improved throughput measurement even on the 1-way server.

IBM @server i5 570 1-way

The 1-way model 570 server invoiced 71,581 order lines per hour in one run and 71,359 order lines per hour in the second run. In both runs, 30 virtual users were used.

Response time – Table 4 shows the average response time for each Web browser transaction on the 1-way model 570. Response times do not include the average one-second think time for each transaction, and they measure the entire length of the run, not just the 90-minute measurement interval.

Step	Number per Order	Average Response Time (Seconds)		90 th Percentile Response Time (Seconds)	
		Run 1	Run 2	Run 1	Run 2
Create Order Head	1	0.130	0.128	0.180	0.180
Insert Order Line	5	0.061	0.062	0.079	0.079
Close Order	1	0.060	0.061	0.099	0.099

Table 4 – Average response times for the 1-way @server i5 570

IBM @server i5 570 2-way

The 2-way model 570 server invoiced 129,767 order lines per hour in one run and 129,403 order lines per hour in the second run. In both runs, 54 virtual users were used.

Response time – Table 5 shows the average response time for each Web browser transaction on the 2-way model 570. Response times do not include the average one-second think time for each transaction, and they measure the entire length of the run, not just the 90-minute measurement interval.

Step	Number per Order	Average Response Time (Seconds)		90 th Percentile Response Time (Seconds)	
		Run 1	Run 2	Run 1	Run 2
Create Order Head	1	0.133	0.137	0.160	0.170
Insert Order Line	5	0.061	0.061	0.069	0.069
Close Order	1	0.061	0.065	0.089	0.099

Table 5 – Average response times for the 2-way @server i5 570

IBM @server i5 570 4-way

The 4-way model 570 server invoiced 247,947 order lines per hour in one run and 247,205 order lines per hour in the second run. In both runs, 104 virtual users were used.

Response time – Table 6 shows the average response time for each Web browser transaction on the 4-way model 570. Response times do not include the average one-second think time for each transaction, and they measure the entire length of the run, not just the 90-minute measurement interval.

Step	Number per Order	Average Response Time (Seconds)		90 th Percentile Response Time (Seconds)	
		Run 1	Run 2	Run 1	Run 2
Create Order Head	1	0.148	0.146	0.190	0.180
Insert Order Line	5	0.066	0.066	0.079	0.079
Close Order	1	0.069	0.067	0.099	0.099

Table 6 – Average response times for the 4-way @server i5 570

Summary

A key challenge for many businesses today is responding to the changes in their organizations, their markets and their competitors. And it is this challenge that makes becoming an On Demand Business the next critical step for many businesses. The Intenia benchmark on iSeries systems demonstrates some of the many ways that IBM @server iSeries servers can help an organization become an On Demand Business.

Whether it is responding to a new business challenge by adding a new application or delivering new levels of employee productivity through improved performance, iSeries servers deliver. And the best news: they can deliver without requiring each application to have its own server, which can add cost and complexity.

Other Notes

- *The just-in-time (JIT) compiler was used for all Movex Business Engine Java Virtual Machine™ (JVM™) environments. The JIT Mixed Mode Interpreter (MMI) threshold was set to 1 to make the throughput more consistent throughout the run. The default MMI threshold setting is more suitable for non-benchmark environments.*
- *Class reloading was disabled in both Workplace and Net Extension. Class reloading is normally enabled during development but should be disabled (or set to a high reload interval) in production environments.*
- *The number of Web container threads used for Workplace and Net Extension was changed to 15. (The default is 80.) This limited the number of requests that Workplace processed concurrently, reducing contention and therefore improving the average response time experienced by users.*



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