

Performance of the SunGard Adaptiv Credit Risk application on Intel- and AMD-based platforms

For Intel Corporation

Executive summary

Intel Corporation (Intel) commissioned Principled Technologies (PT) to run SunGard's Adaptiv Credit Risk workload on two servers in various configurations. One server contained two Intel Xeon 3.6 GHz processors with Hyper-Threading Technology (HT Technology); the other used two AMD Opteron 2.6 GHz processors. Both had 8GB of RAM. We compared the performance of the two servers, and we also gauged how performance scaled on the Intel Xeon processor-based server when upgrading from one to two processors and when running with and without HT Technology enabled.

Per SunGard, "SunGard Adaptiv Credit Risk provides a total, real-time credit risk solution for counterparty credit exposure aggregation, global limit management, credit risk analytics and collateral management." The SunGard Adaptiv Credit Risk workload performs an analysis on a large portfolio of client assets and generates a credit risk evaluation. The more quickly the workload completes, the more quickly the user receives the evaluation, so improving performance can improve productivity.

Performance of the application can increase as it runs with more threads. By default, it detects the number of processors, logical or physical, and runs with one thread per processor. Thus, by default the application runs with four threads on the Intel Xeon processor-based server, because that server has two physical processors with two logical processors each. On the AMD Opteron processor-based server, by contrast, the application by default runs with only two threads, one per processor.

Key findings

- ❖ In both the one- and two-processor configurations, the Intel Xeon processor-based server outperformed the AMD Opteron processor-based server on the standard SunGard Adaptiv Credit Risk workload setup (see Figures 1 and 2).
- ❖ With the standard application setup, the two-processor Intel Xeon processor-based server completed the workload almost twice as fast as the same server with one Intel Xeon processor (see Figure 3).
- ❖ HT Technology on the Intel Xeon processor-based server significantly increased performance on the SunGard Adaptiv Credit Risk workload with multiple workload threads (see Figure 4).

Figures 1 through 4 illustrate the relative performance of a few key server configurations with the number of threads the SunGard Adaptive Credit Risk application used by default on each configuration.

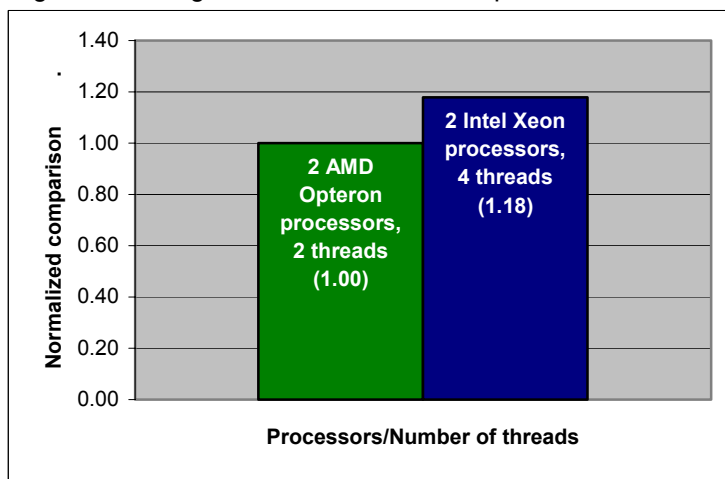


Figure 1: Dual-processor performance of the two servers with the default application configuration.

In each of these figures we normalized the results to the time the slower configuration took to complete the workload; that configuration's result in each chart is thus always 1.00. By normalizing we make each data point in these three charts a comparative number; higher results mean better performance (i.e., faster times to complete the workload at the specified thread count).

As Figure 1 shows, with the default application configurations, the Intel-based server performed about 18% faster than the AMD Opteron processor-based server, delivering a solution over three minutes quicker.

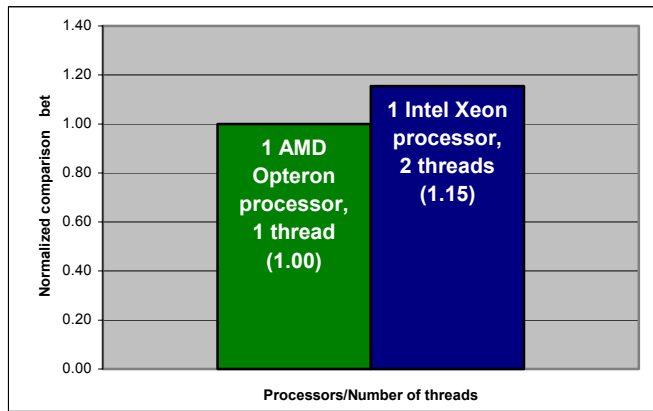


Figure 2: Single-processor performance of the two servers with the default application configuration.

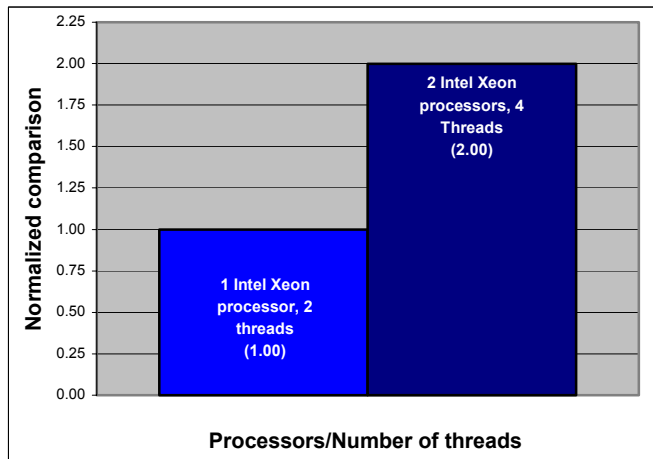


Figure 3: One- to two-processor performance scaling on the Intel Xeon processor-based server using the default application configuration.

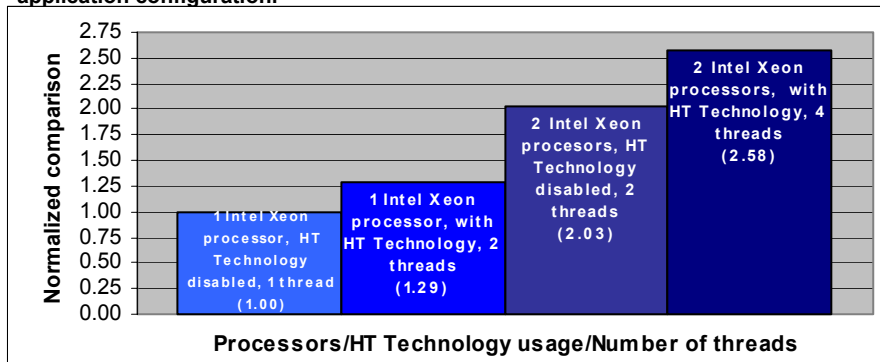


Figure 4: Performance improvements from the use of HT Technology on the Intel Xeon processor-based server with the default application configurations.

Figure 2 presents the same basic comparison, again using the default application configurations, but this time with only a single processor and 4GB of RAM in each. When we ran the single-processor tests, we physically removed the second processor. Because the AMD Opteron processor-based server assigns each CPU its own RAM, we also removed the RAM associated with the second processor, which left the server with 4GB of RAM. Though the Intel Xeon processor-based server does not associate RAM with specific processors, to ensure fair and consistent results we also reduced the RAM in that system to 4GB for the single-processor tests.

The Intel Xeon processor-based server demonstrated significant performance gains on the SunGard Adaptiv Credit Risk workload both from the presence of the second processor and its use of HT Technology. As you can see in Figure 3, performance in the default application configurations nearly doubled with the addition of a second Intel Xeon processor. Figure 4 shows that using HT Technology also significantly improved performance in the default application configurations.

In addition to the tests in these Figures, we ran many other tests on each server. We tested the single-physical-processor configurations with 1, 2, 3, and 4 workload threads; on the dual-physical-processor configurations we tested with 1, 2, 3, 4, 5, and 6 workload threads. Intel provided the servers and workload; we executed all tests with clean installations of Microsoft Windows 2003 Server, Enterprise Edition, Service Pack 1. The Test results section details the results of all tests.

About SunGard

Per SunGard, "SunGard is a global leader in integrated software and processing solutions, primarily for financial services and higher education. SunGard also helps information-dependent enterprises of all

types to ensure the continuity of their business. SunGard serves

more than 20,000 customers in more than 50 countries, including the world's 50 largest financial services companies. The SunGard Adaptiv Credit Risk solution (www.sungard.com/adaptiv) is a risk management system that supports the credit risk management of a bank on all levels by combining comprehensive credit risk related functionality, powerful real-time analytic capabilities and sophisticated user interfaces and reporting. It provides global scalability, real-time performance and the capacity to handle vast trading volumes." SunGard Adaptiv Credit Risk has an open architecture and uses middleware, XML-based formats, industry standard technologies, and data standards.

Test results

Figure 5 details the results of our tests. For each test we present the median of the three individual test runs. The test produces the time, in seconds, the server took to complete the workload; lower (faster) completion times are better. Entries that read “N/A” designate tests we did not perform.

Server System\# of threads	1	2	3	4	5	6
AMD Opteron - 1 processor	2,368.34	2,370.66	2,375.13	2,383.27	N/A	N/A
AMD Opteron - 2 processors	2,369.03	1,210.89	1,241.58	1,230.86	1,242.70	1,231.02
Intel Xeon - 1 processor	2,586.17	2,051.86	2,018.14	2,036.17	N/A	N/A
Intel Xeon - 2 processors	2,568.30	1,326.98	1,266.85	1,027.13	1,111.74	1,080.03
Intel Xeon - 1 processor (HT Technology disabled)	2,648.70	2,553.14	2,559.08	2,561.78	N/A	N/A
Intel Xeon - 2 processors (HT Technology disabled)	2,636.39	1,302.11	1,379.94	1,378.31	1,326.05	1,311.80

Figure 5: Median completion times (seconds) of the server configurations with varying thread counts. Lower times are better.

Test methodology

Figure 6 summarizes a few key aspects of the configurations of the two server systems; Appendix A provides detailed configuration information.

Server System	Intel S3E1411 Server System (Alief)	AMD Opteron Server System
Processor frequency (GHz)	3.6	2.6
Motherboard	Intel Server Board SE7520AF2	Tyan S2882UG3NR
Chipset	Intel E7520	AMD-8131
RAM (8192MB in each)	8 x 1024MB PC2-3200 DDR2-SDRAM	8 x 1024MB PC-3200 DDR-SDRAM
Hard drive (one 18GB)	Seagate Cheetah ST318453LC	Seagate Cheetah ST318453LC

Figure 6: Summary of key aspects of the server configurations.

Intel configured and provided both servers. The difference in RAM types reflects the capabilities of the two motherboards: The Intel motherboard supported DDR2 RAM, while the Tyan did not. As the Memory module(s) section of Appendix A shows, however, the two systems ran their RAM at almost identical speeds. Thus, we do not believe the difference in RAM types was the source of any significant difference in the performance of the two servers.

We installed a fresh copy of Microsoft Windows 2003 Server, Enterprise Edition on each server. We followed this process for each installation:

1. Assigned a computer name that reflected the processor name and vendor.
2. For the licensing mode, we used the default setting of five concurrent connections.
3. Did not enter a password for the administrator log on.
4. Selected Eastern Time Zone.
5. Used typical settings when setting up Network installation.
6. Used “WORKGROUP” for the workgroup.

The Microsoft Windows Update site suggested the following updates for both servers, which we applied:

- Service Pack 1
- DirectX 9.0c End-User Runtime
- Update for Windows Server 2003 (KB898715)
- Windows Malicious Software Removal Tool - May 2005 (KB890830)

The Microsoft Windows Update site suggested the following updates for the AMD Opteron processor-based server, which we applied:

- Intel Corporation - Networking - Intel(R) PRO/100 S Server Adapter - Released March 04, 2005
- Silicon Image, Inc. - Storage - Silicon Image Sil 3114 SATALink Controller - Released on May 05, 2005

SunGard developed the Adaptiv Credit Risk application in Microsoft C#. The application executes as a process within the host Microsoft .NET framework and requires a specific version of .NET, so we downloaded and installed that version: Microsoft .NET Framework Version 2.0.50215.45 Beta 2 (available at <http://msdn.microsoft.com/netframework/>).

We rebooted the server before each test run.

To enable or disable HT Technology on the Intel-based server, we used the BIOS' HT setting, which is in the Advanced page of the BIOS in the Processor Configuration section.

Testing with one processor on a dual processor server

When we ran the single-processor tests on each server, we physically removed the second processor. Because the AMD Opteron processor-based server assigns each CPU its own RAM, we also removed the RAM associated with that second processor, which left the server with 4GB of RAM. Though the Intel Xeon processor-based server does not associate RAM with specific processors, to ensure fair and consistent results, we also reduced the RAM in that system to 4GB for the single-processor tests.

Installation of the SunGard Adaptiv Credit Risk workload

Intel shipped us the SunGard Adaptiv Credit Risk application and workload compressed in a zip file on CD-ROM. We unzipped the file's contents into the folder C:\SCRA on each system. The files in that folder contained both the SunGard Adaptiv Credit Risk executable (RiskAnalytics.exe) and the two data files the workload uses:

- *MarketData.dat* – sample data representing a fictional set of financial market conditions
- *Portfolio D.cpf* – sample data representing a fictional customer's investment portfolio

SunGard Adaptiv Credit Risk workload switches/parameters

The workload provides the following switches, which we set as appropriate for each test run:

- */numThreads or /t*
Designates the number of threads the workload should run. We set this to the number of threads we wanted in each test.
- */batch or /b*
Tells the workload to start calculating once it is running and to shut down when it completes the run. We did not use this switch.
- */outputFileName or /o*
Saves the results in a text file and overwrites that file if the file already exists. We saved each test's results in a separate file.
- */appendOutputFileName or /a*
Saves the results in a text file and appends new results to that file if the file already exists. We did not use this switch.

By default, the application detects the number of logical processors and runs with one thread per logical processor. So, by default the application would run as follows:

- AMD Opteron processor-based server with 1 processor: 1 thread
- AMD Opteron processor-based server with 2 processors: 2 threads
- Intel Xeon processor-based server with 1 processor and HT Technology disabled: 1 thread

- Intel Xeon processor-based server with 1 processor and HT Technology enabled: 2 threads
- Intel Xeon processor-based server with 2 processors and HT Technology disabled: 2 threads
- Intel Xeon processor-based server with 2 processors and HT Technology enabled: 4 threads

The typical state of the Intel-based server is to run with HT Technology enabled. Consequently, the Intel Xeon processor-based server would by default run the application with more threads in both the one- and two-processor configurations than the AMD Opteron processor-based server.

Running the SunGard Adaptiv Credit Risk workload

We rebooted the server before each individual test and then followed this process to run the test:

1. Opened a DOS command window, and navigated to the C:\SCRA folder.
2. Entered the following command:
`RiskAnalytics /o <server name>_<# of CPUs>_<# of threads>_<run no.>.txt /t <# of threads>`
 where
 - <server name> was either Intel or AMD, as appropriate
 - <# of CPUs> was either 1 or 2, as appropriate
 - <# of threads> was either 1, 2, 3, 4, 5, or 6, as appropriate
 - <run no.> was either 1, 2, or 3 (as we ran each test three times)
3. The workload would then start and open a monitoring console like the one in Figure 7, but without the results graph (see next point for more on that graph). After the workload starts its calculation, a “Percentage Complete” progress message displays in the bottom left corner of the status bar.
4. When the workload completes, the monitoring console presents a graph of the results over the course of the test; Figure 7 shows an example graph. The text below the graph in the display describes the parameters the workload used for this run and the time (in seconds) it took to complete the test. We recorded this time as the primary result of each test.



Figure 7: An example of the monitoring console after the SunGard Adaptiv Credit Risk workload completes.

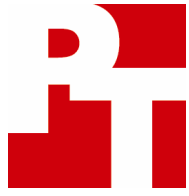
Appendix A: Test system configuration information

This appendix provides detailed configuration information about each of the two test server systems.

Processors	Intel Irwindale 3.6 GHz dual processor	AMD Opteron 2.6 GHz dual processor
System configuration information		
General		
Processor and OS kernel: (physical, core, logical) / (UP, MP)	2P1C2L / MP and 2P1C4L / MP	2P1C2L / MP
Number of physical processors	2	2
Single/Dual Core processors	Single core	Single core
System Power Management Policy	AC/Always On	AC/Always On
CPU		
System type	Server	Server
Vendor	Intel	AMD
Name	Intel Xeon	AMD Opteron
Code name	Irwindale	San Diego
Stepping	3	1
Socket type	604	940
Core frequency	3600	2600
Front-side bus frequency	800	1000
L1 Cache	16K + 12K	64K + 64K
L2 Cache	2048 KB	1024 KB
Platform		
Vendor and model number	Intel S3E1411 Server System (Alief)	Monarch Empro Custom 2U rack server system
Motherboard model number	Intel Server Board SE7520AF2	Tyan S2882UG3NR
Motherboard chipset	Intel E7520	AMD-8131
Motherboard chipset codename	Lindenhurst	N/A
Motherboard revision number	0	1
Motherboard serial number	KRA145100053	1000005057
BIOS name and version	American Megatrends version SE7520AF20.86B.I.06.00.0092, 12/23/2004	American Megatrends version 080010 63-0100-000001-00101111-041805-OPTERON, 4/18/2005
BIOS settings	Default	Default
Chipset INF driver	Microsoft version 5.2.3790.1830	Microsoft version 5.2.3790.1830
Memory module(s)		
Vendor and model number	Infineon HYS72T128000HR-5-A	Kingston HyperX KRX3200AK2/2G
Type	240-pin DDR2-SDRAM PC2-3200 ECC Registered	184-pin DDR400-SDRAM PC3200 ECC Registered
Speed (MHz)	400	400
Speed in the system currently running @ (MHz)	200	200
Timing/Latency (tCL-tRCD-tRP-tRASmin)	3.0-3-3-8	2.5-3-3-8
Size	8192MB	8192MB

Number of sticks	8 x 1 GB	8 x 1 GB
Chip organization	Double-sided	Double-sided
Channel	Dual	Dual
Hard disk		
Vendor and model number	Seagate Cheetah ST318453LC	Seagate Cheetah ST318453LC
Number of disks in system	1	1
Size	18 GB	18 GB
Buffer Size	8 MB	8 MB
RPM	15000	15000
Type	Ultra320 SCSI	Ultra320 SCSI
Controller	Intel RAID Controller SROMBU42E	Adaptec AIC-7902B
Driver	Intel version 6.43.32.0	Adaptec version 3.0.0.0
Operating system		
Name	Microsoft Windows 2003 Server, Enterprise Edition	Microsoft Windows 2003 Server, Enterprise Edition
Build number	Build 3790	Build 3790
Service pack	Service Pack 1	Service Pack 1
Microsoft Windows update date	05/20/2005	05/20/2005
File system	NTFS	NTFS
Kernel	ACPI Multiprocessor PC	ACPI Multiprocessor PC
Language	English	English
Microsoft DirectX version	DirectX 9.0c	DirectX 9.0c
Graphics		
Vendor and model number	ATI Rage XL Family	ATI Rage XL Family
Chipset	B41	B41
BIOS version	GR-xltyns3y.004.4.332	GR-xltyns3y.004.4.332
Type	Integrated	Integrated
Memory size	8 MB Shared DDR	8 MB Shared DDR
Resolution	1024 x 768 x 32-bit color	1024 x 768 x 32-bit color
Driver	ATI Technologies version 5.10.2600.6014	ATI Technologies version 5.10.2600.6014
Network card/subsystem		
Vendor and model number	Intel PRO/1000 MT Dual Port Network Connection	Intel PRO/100 S Server adapter
Type	Integrated	Integrated
Driver	Intel version 8.5.14.0	Microsoft version 6.6.8.1
Other Network Card Information	N/A	2 Broadcom BCM5704C Gigabit integrated network adapters connected to PCI-X Bridge A
Optical drive		
Vendor and model number	Samsung TS-H352A DVD-ROM (DVD Read 16x, CD-ROM Read 48x)	ASUS QuieTrack CRW-5232AX (Read 52x, RW 32x, Write 52x)
Type	DVD-ROM	CD-RW
Interface	Internal	Internal
USB ports		
# of ports	5 (2 front, 3 back)	3 (1 front, 2 back)
Type of ports (USB1.1, USB2)	1.1	1.1

Figure 8: Detailed system configuration information for both servers.



Principled Technologies

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