IBM Power Systems with IBM i single core server tuning guide for JD Edwards EnterpriseOne

Diane Webster
IBM Oracle International Competency Center
January 2012

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Change history

Version	Date	Author	Editing Description
1.0	January 2012	Diane Webster	Original

Abstract

IBM and Oracle remain committed to providing customers with an integrated, scalable JD Edwards EnterpriseOne environment leveraging the latest processor technology and software solution.

IBM i Solution Edition for JD Edwards provides a complete integrated solution that combines the highly available IBM i operating system and IBM POWER7® servers with JD Edwards ERP software to help reduce the cost, complexity and risk of deploying an ERP solution. The IBM i Solution Editions are designed to take advantage of the experience and expertise of IBM and various software vendors to help you build greater business value with your IT investments. One Solution Edition option for JD Edwards EnterpriseOne (feature code 4975 or 4928) is a single socket system with one licensed core which is created specifically to provide a cost-effective option for small businesses, or branch offices with 50-100 users.

The single-core Power® 720 Solution Edition for IBM i systems are extremely powerful servers, but there are things to consider to fully leverage the capabilities of the single-core. This paper provides tuning recommendations for managing workloads which include both batch and interactive requirements on the single-core Solution Edition system.

Introduction

Power 720 Solution Edition for IBM i (feature code 4974 or 4928) is based on the entry four-core 3.0 GHz POWER7 processor card. It comes with one licensed core. Like all other POWER7 servers, each core leverages intelligent threads. With the intelligent thread technology, the system automatically switches between one, two or four execution threads to optimize application throughput. In addition, IBM i 7.1 provides “dynamic switching” capabilities. Dynamic switching allocates resources to optimize the processing capability. Therefore, if a job requires only one thread, the other three threads will free up resources, giving the single thread greater performance.

This paper will discuss general tuning guidelines and workload management techniques which will help leverage the full capabilities of a single core system for batch workloads, while protecting interactive response time. These tuning recommendations cover POWER7 servers with i and the JD Edwards EnterpriseOne application. All components discussed are running on IBM i 7.1.

This document is a companion to two other whitepapers:

- “IBM Power Systems with IBM i Performance and Tuning Tips for Oracle’s JD Edwards EnterpriseOne 9.0” which covers tuning recommendations for the JD Edwards EnterpriseOne Enterprise Server. It can be found at:
  - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101504.
- “IBM Power Systems with IBM i performance and tuning tips for Oracle’s JD Edwards EnterpriseOne WebSphere-based HTML servers” which discusses tuning recommendations for the web servers. It can be found at:
  - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101777

General tuning recommendations

The entry level Solution Edition system as recommended comes with 8 drives and 16 gigabytes of memory. As a result three general areas deserve special consideration, the memory pool configuration, page fault rates, and disk arm usage.

Memory pool configuration

In general, for configurations with 16 gigabytes of RAM, it is not necessary to create shared pools to separate workload activity. The default four-pool definition, shown in Figure 1, will provide good overall performance. Testing showed that shared pool configurations could lead to higher faulting rates and slightly worse performance. JD Edwards EnterpriseOne interactive and batch jobs use many of the same database and program files. Therefore for smaller systems, it is generally more efficient to let the system manage the memory in a single pool than to separate the workloads.

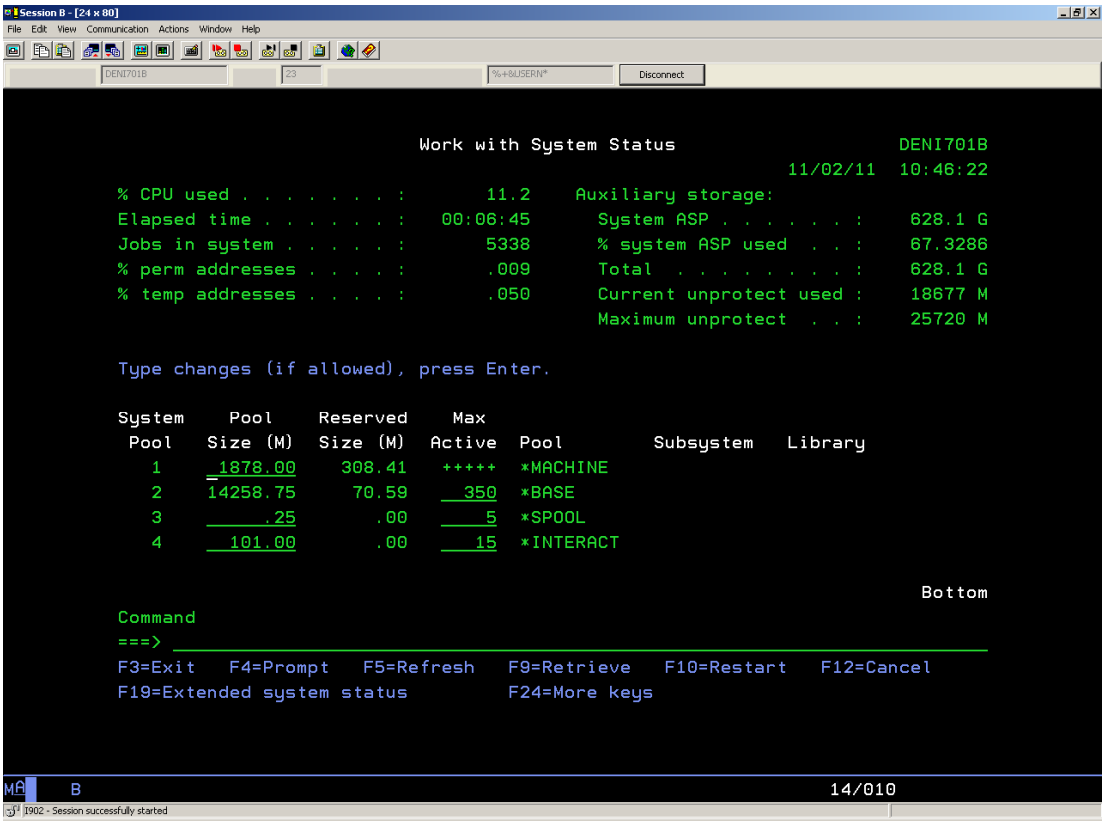

Figure 1- Default memory pool configuration

This recommendation does not necessarily apply to large systems with diverse workloads or large databases. Additional factors will influence whether the default pool configuration is not sufficient for specific customer environments. Some of these factors include use of large long-running performance critical batch jobs, use of non-Oracle JD Edwards EnterpriseOne applications or requirements for large data extractions.

Page faulting rates

For best overall performance, ensure that the total page fault rate for the system stays under 100 page faults per second total for all pools. Also ensure that the machine pool faulting is less than 10 page faults per second. Ensuring that faulting rates stay within these guidelines can help reduce the work that the disk drives need to perform and results in better overall system performance.

Given the limited number of disk drives on the single core systems, this is especially important for maintaining overall performance.

The best way to determine the page faulting rates is to use the performance tools, (IBM licensed program product 5770PT1). You should print a component report and analyze the Component Interval Activity section.

NOTE: To create a component report to review the interval page fault rates, use the PRTCPTRPT command: PRTCPTRPT MBR(<member>) TYPE(*INTERVAL) where <member> is the name of the performance data collection member.

								Int	Int	DB	----- Disk I/O ------		High	Pool			Excp
Itv End	Tns /Hour	Rsp /Tns	DDM I/O	-CPU Total	Utilization- Inter	Batch	Feat Util	CPU >Thld	Cpb Util	----- Per Second ---- Sync	Async	-Utilization- Disk	Unit	-Faults/Sec- Mch	User	ID	per Second
11:30	26	.00	0	39.8	.0	39.8	.0	0	.0	31.9	36.5	2	0006	0	44	04	123.9
11:35	168	.00	0	92.2	.0	92.2	.0	0	.0	157.7	207.8	7	0002	0	30	02	125.6
11:40	0	.00	0	92.2	.0	92.2	.0	0	.0	122.1	163.3	4	0001	0	23	02	115.5
11:45	0	.00	0	92.3	.0	92.3	.0	0	.0	144.3	182.1	5	0001	0	33	02	123.8
11:50	0	.00	0	92.2	.0	92.2	.0	0	.0	121.4	165.5	4	0001	0	27	02	101.6
11:55	0	.00	0	92.8	.0	92.8	.0	0	.0	171.2	139.0	5	0001	0	33	02	139.5
12:00	0	.00	0	93.2	.0	93.2	.0	0	.0	123.8	98.8	4	0001	0	23	02	116.0
12:05	0	.00	0	92.0	.0	92.0	.0	0	.0	118.7	179.1	4	0004	0	21	02	109.9
12:10	0	.00	0	92.2	.0	92.2	.0	0	.0	135.7	209.3	5	0002	0	26	02	124.6
12:15	0	.00	0	91.6	.0	91.6	.0	0	.0	137.0	210.8	5	0002	0	27	02	116.6
12:20	0	.00	0	91.8	.0	91.8	.0	0	.0	151.6	226.2	5	0001	0	27	02	128.2
12:25	0	.00	0	92.7	.0	92.7	.0	0	.0	126.3	198.1	4	0002	0	27	02	114.5
12:30	0	.00	0	91.8	.0	91.8	.0	0	.0	141.8	209.8	5	0001	0	32	02	118.4

Figure 2 - Component interval activity report

If you see multiple intervals where faulting is greater than 100 in the “User” column or greater than 10 in the “MCH” column, additional investigation is warranted. If faulting rates exceed these guidelines, you may need to adjust memory sizes in the pools, or you may need to reduce the number of concurrent batch jobs.

It is not always necessary to make changes to the system when you exceed these guidelines. For additional guidance on memory tuning, see section 8.2.1 in the “End to End Performance Management on IBM i” redbook. The link to this document is provided in the “Resources” section of this document.

Before making any changes to the pool configuration, review the system value, QPFRADJ.

NOTE: Use the command WRKSYSVAL QPFRADJ to determine the current setting for the system value.

QPFRADJ determines whether the system will automatically make changes to the memory configuration to best utilize the system resources. The shipped value of QPFRADJ is 2, which performs adjustments at IPL and periodically during day. If QPFRADJ is set to 2, any changes you make will not be preserved. This is typically a good setting to keep in place. However, if you need to manually make adjustments to pool sizes, change QPFRADJ to “0”.

Disk arm usage

During lab testing, we were not able to drive the disk arm usage to a point where it impacted end user response time, or UBE performance using the typical workload expected for the single core system. However, each customer scenario is different. Therefore, in some cases, disk arm utilization may need to

be considered. This section will show how to review disk arm performance. The data shown here is taken from a workload that is over three times the workload that is expected to run on the system.

To analyze disk performance, use the IBM i Systems Director Navigator for i. This is accessed with the URL:

- http://<system_name>:2001/ibm/console (where <system_name> is the name of your IBM i system).

Once you are logged in to Systems Director Navigator, use the following path. Open the IBM i Management section in the left hand navigator bar > Click on Performance > Click on Investigate Data in the right hand tab> Under Perspectives, click Health Indicators> Click Disk Health Indicators. (See Figure 3).

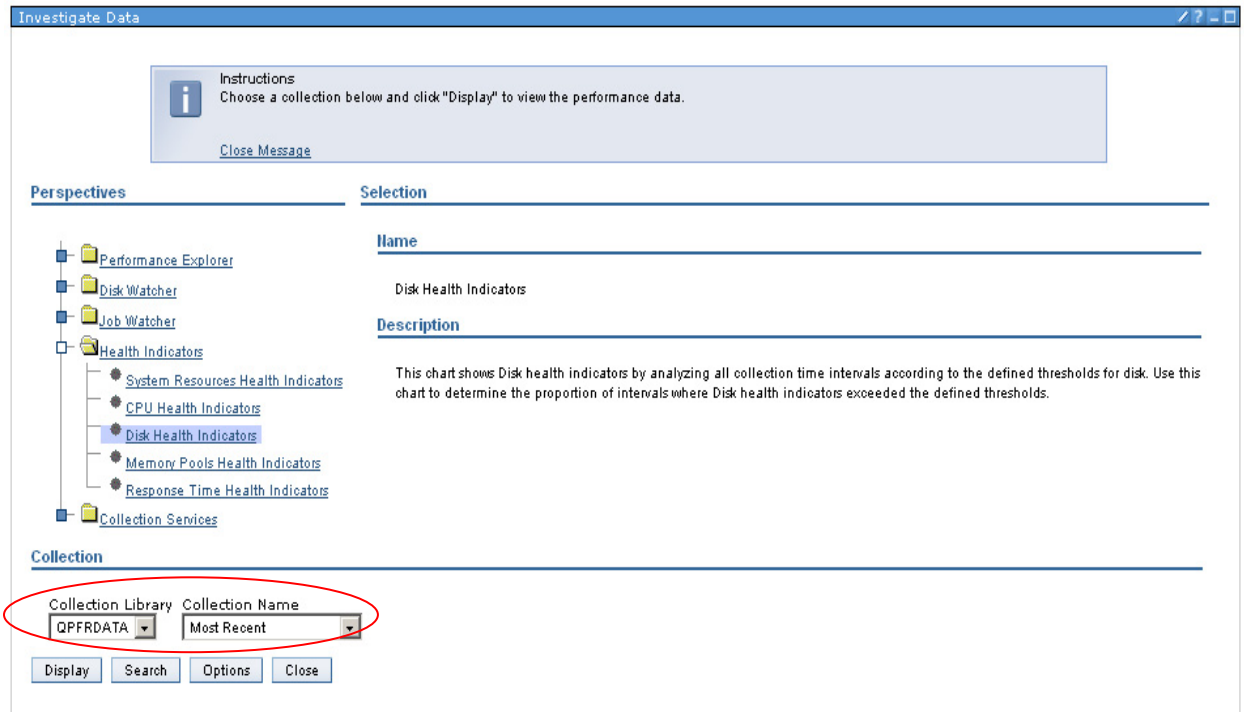

Figure 3 - Investigate performance data

Under the Collection Library and Collection Name, select the library and collection name that you want to analyze. This will default to the most recent performance data collection on the system, including the current active data collection. Then click Display.

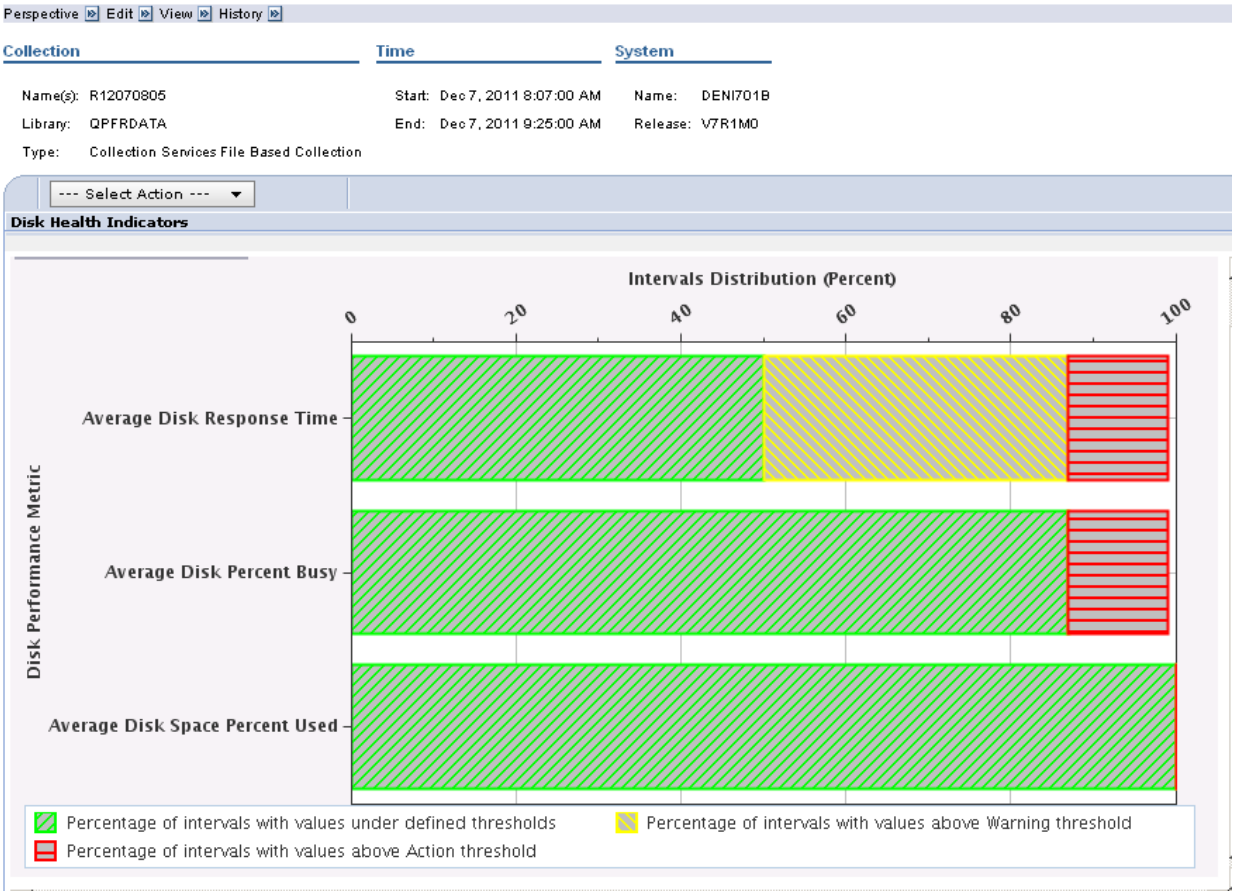

Figure 4 - Disk health indicators

In this case, we see that over 50% of the disk arm response time is either in Action or Warning threshold. By default, the Warning response time is 2 milliseconds and the Action response time is 6 milliseconds. We also see that over 10% of the disk percent busy has exceeded the action threshold (30%). This scenario needs additional analysis.

In the Select Action Drop box, select Disk Details by Disk Pool.

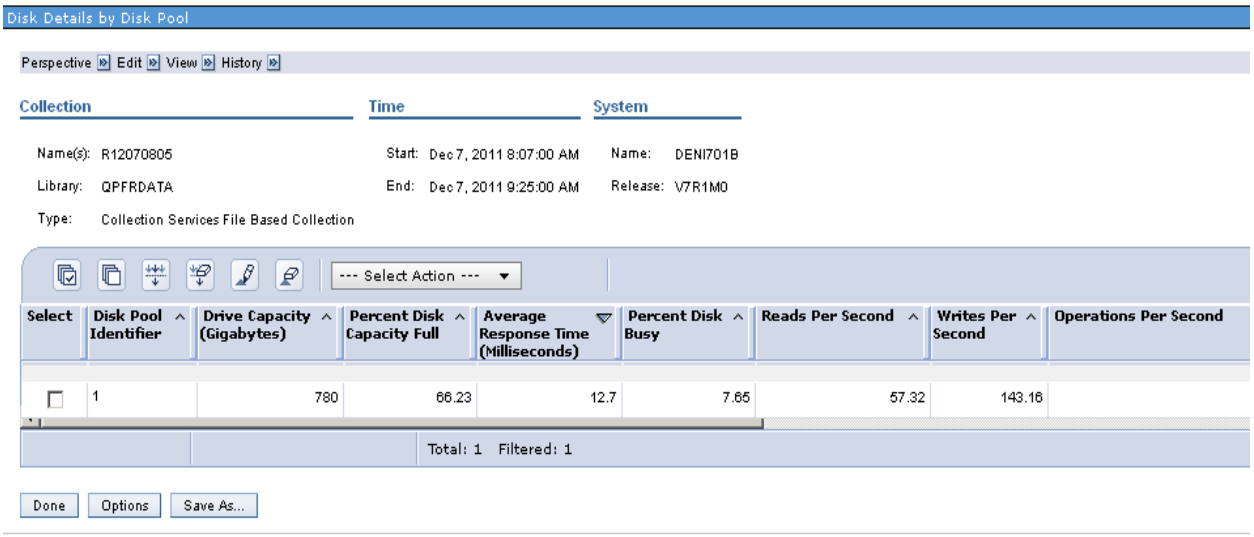

Figure 5 - Disk details by disk pool

This report (Figure 5) gives us the summary level information for disk pool 1 and it will let us drill down into more detailed statistics for the disk pool. From the Select Action drop down box, select Disk I/O Average Response Time Overview.

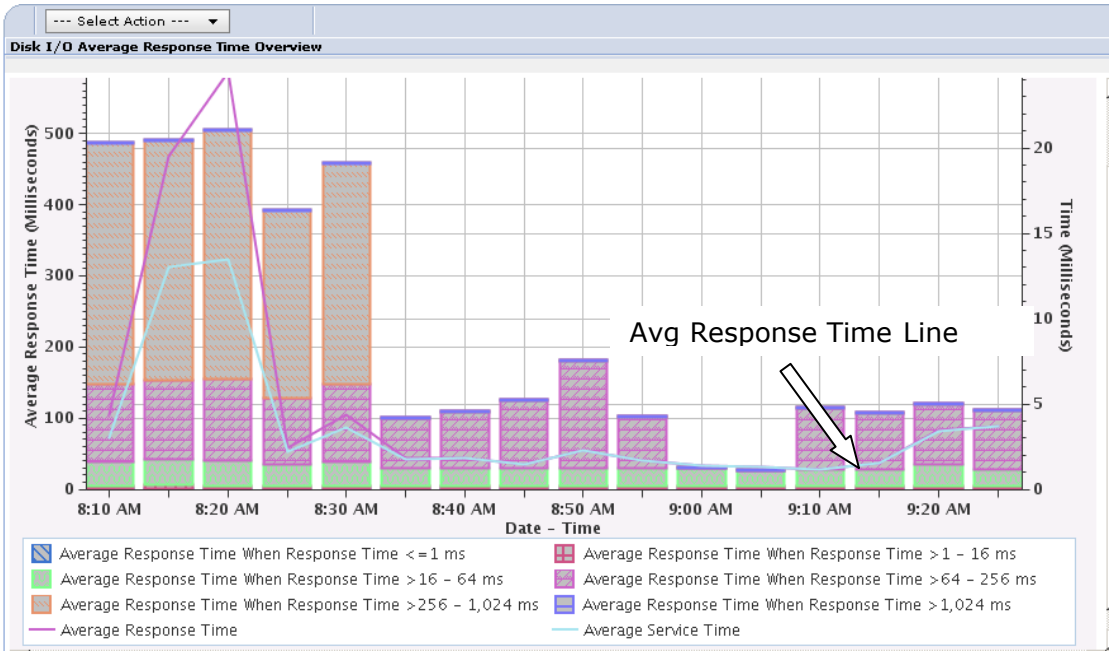

Figure 6 - DIsk I/O average response time

From the Disk I/O Average Response Time Overview, (Figure 6), we can see that from approximately 8:10 am until 8:30 am, we had very high disk arm average disk arm response times. We also see that from 8:35 am until the end of the collection sample, the average service time for the disk arms was less than 5 milliseconds. We now know that the majority of the disk service time problems are for a specific time period.

Now let's drill into a graph which shows us the performance of each disk arm. Click Done. Back on the Disk Detail by Disk Pool screen, in the Select Action dropdown, select Disk Overview for Disk Units. This will display two graphs, one showing the Disk Service times for each disk arm, and one showing the Disk Arm Utilization for each disk arm.

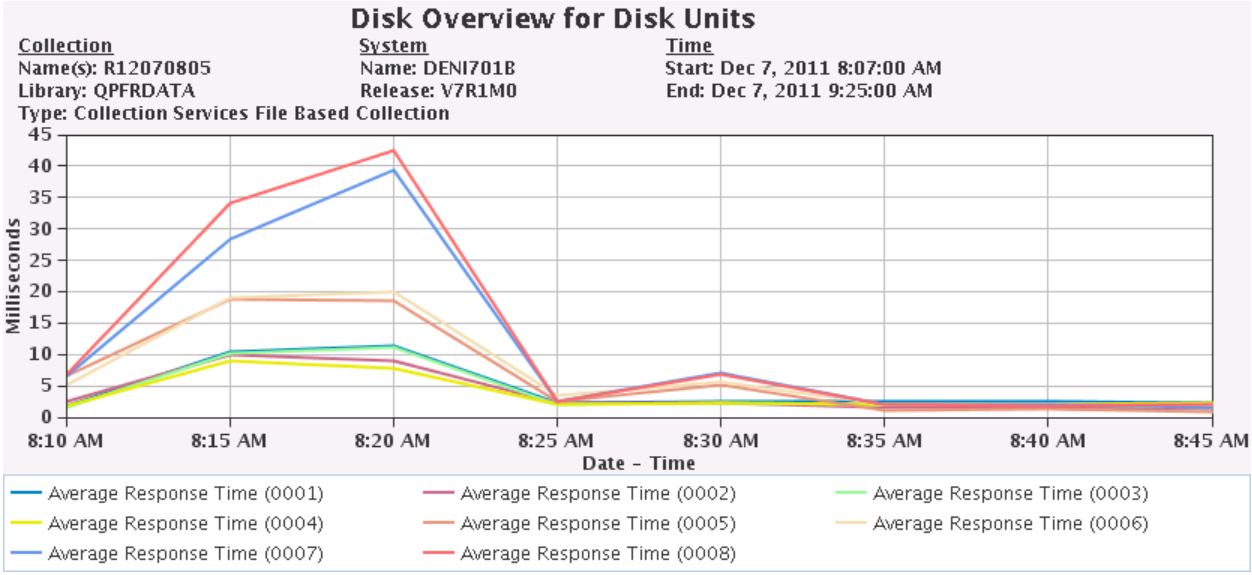

Figure 7 - Disk arm response tIme

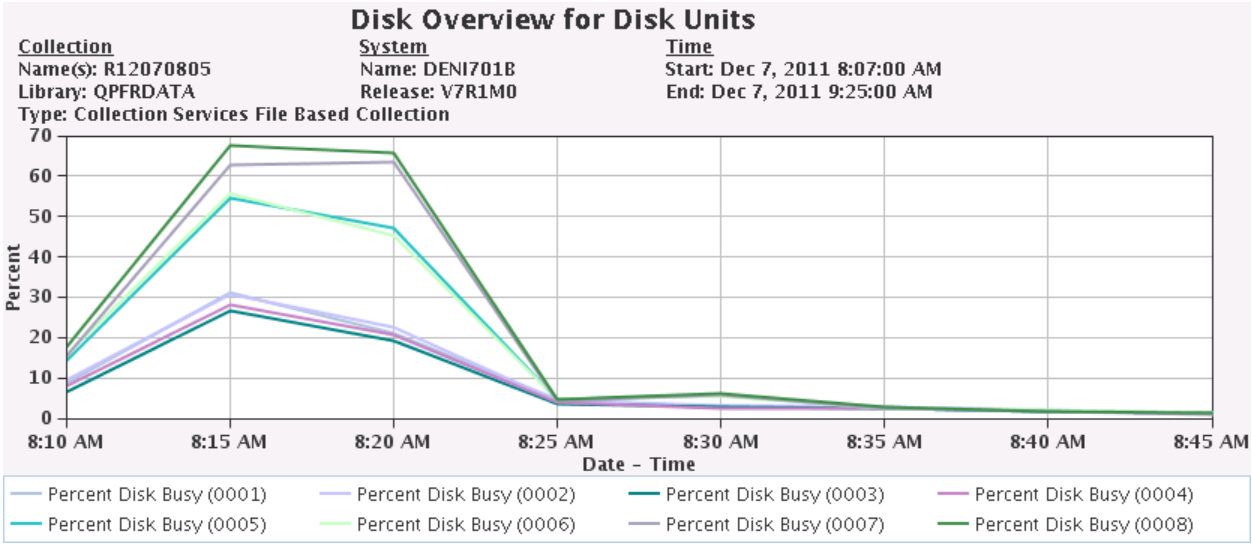

Figure 8 - Disk arm utilization

From these graphs we see that all disk arms have elevated disk service times (Figure 7) and disk arm utilizations (Figure 8), but arms 0007 and 0008 have much worse performance statistics than all other drives. There could be multiple causes of this that should be investigated:

- A run away job
- High faulting in a memory pool
- Hot spots on a disk drive
- Heavy workload

- Missing indexes which cause full table scans

In a case like this, disk performance should be watched over a period of time to determine if this is a regular occurrence which needs to be addressed or whether this was an anomaly in the system.

NOTE: The cause of this issue was an anomaly, that occurred after a system restart when 500 users logged on within a 5 minute period.

Concurrent UBEs

A key to successfully leveraging the resources of the POWER7 processor with JD Edwards EnterpriseOne is determining the optimal configuration for UBEs (Universal Batch Engines). There are several scenarios to consider when planning for UBEs on IBM i. The first scenario is the typical nighttime batch window with heavy batch processing and few if any interactive users. The second scenario is the processing of batch jobs concurrently with on-line users.

Batch window

Depending on the number and types of jobs in the batch windows, you have several options.

1. You can run UBEs single-threaded. Based on lab testing, a single UBE can use between 40% and 60% of the system when running dedicated. This leverages the dynamic switching capabilities that are inherent in the POWER7 processor which lets the single process most efficiently use the single CPU core.
2. Two UBEs running concurrently can take between 70% and 80% CPU. In the lab, the runtime of the UBEs can be approximately 20-30% longer than when running the same process as a stand-alone UBE.

For critical jobs where runtime is important and runtime objectives can not be met, try to run those UBEs single-threaded.

If on the other hand, you need to process large quantities of UBEs during the batch window, run two or even three UBEs concurrently. Base the decision on whether to add additional concurrent UBEs on the following criteria:

- CPU utilization is under 90%
- Page fault rates are under the guidelines provided above
- Runtimes of the current UBEs are acceptable

NOTE: Running three UBEs concurrently generally will also impact the run time of the UBEs.

If the first two criteria can be met, but you need to maintain processing time for critical jobs, you may want to configure the system to run fewer critical jobs at lower priorities. This is discussed in detail in the “Workload management” section below.

Batch Jobs with interactive users

All UBEs by default run at priority 50. Additionally, JD Edwards EnterpriseOne HTML users run at priority 20 by default. Therefore in general, the interactive users will be given access to the CPU before UBE

CPU requests are scheduled. There are no scheduling algorithms on IBM i for disk I/O or memory. Therefore heavy batch activity can have some impact on interactive response time. Based on testing in the lab, two concurrent UBEs is the ideal number of jobs for optimal end user response time and batch throughput.

Similar to the batch window recommendations, you can run three UBEs concurrently, if the following criteria are met:

- CPU utilization is under 90%
- Priority 20 CPU utilization is below 50%.
- Page fault rates are under the guidelines provided above
- Interactive response times are acceptable
- Runtimes of current UBEs are acceptable

The best way to determine the CPU utilization that can be attributed to the JD Edwards EnterpriseOne HTML users is to review the Resource Utilization Expansion section of the System Report. One section of this report breaks out the CPU utilization by priority as shown in Figure 9.

NOTE: To create a system report to review the Resource Utilization Expansion information, use the PRTCPTRPT command: PRTSYSRPT MBR(<member>) TYPE(*RSCEXPN) where <member> is the name of the performance data collection member.

	Job	CPU	Cum		Disk I/O		CPU Per I/O		DIO /Sec	
Pty	Type	Util	Util	Faults	Sync	Async	Sync	Async	Sync	Async
000	System	1.5	1.5	159	21,538	23,190	.0019	.0018	5.5	5.9
001	Batch	.0	1.5	141	336	546	.0005	.0003	.0	.1
009	System	.0	1.6	0	34	22	.0196	.0303	.0	.0
010	Batch	.0	1.6	47	58	2	.0031	.0900	.0	.0
015	System	.0	1.6	1	61	97	.0002	.0001	.0	.0
016	System	.0	1.6	106	1,494	403	.0000	.0001	.3	.1
020	PassThru	.0	1.6	16	23	3	.0027	.0209	.0	.0
	Batch	33.9	35.5	84,567	418,640	338,793	.0021	.0027	108.1	87.4
	AutoStart	.0	35.5	0	0	0	.0000	.0000	.0	.0
	DDM Server	.0	35.5	0	0	0	.0000	.0000	.0	.0
	IBM i Access-Bch	.0	35.5	562	1,045	234	.0001	.0007	.2	.0
	System	.0	35.5	7	21	250	.0070	.0005	.0	.0
025	Batch	1.4	37.0	42	51	16	.7869	2.5083	.0	.0
	AutoStart	.0	37.0	0	0	0	.0000	.0000	.0	.0
	IBM i Access-Bch	.0	37.0	0	0	0	.0000	.0000	.0	.0
030	Batch	.0	37.0	0	0	0	.0000	.0000	.0	.0
035	Batch	.0	37.0	0	0	0	.0000	.0000	.0	.0
036	System	.0	37.0	0	0	0	.0000	.0000	.0	.0
040	Batch	.0	37.0	0	0	0	.0000	.0000	.0	.0
	System	.0	37.0	31	916	815	.0001	.0001	.2	.2
049	System	.0	37.0	0	0	0	.0000	.0000	.0	.0
050	Batch	51.3	88.3	18,910	83,102	326,583	.0167	.0042	21.4	84.3
	AutoStart	.0	88.3	0	165	36	.0001	.0006	.0	.0
	System	.0	88.3	16	184	104	.0010	.0018	.0	.0
052	System	.2	88.6	37	3,323	23,311	.0018	.0002	.8	6.0
055	System	.0	88.6	0	0	0	.0000	.0000	.0	.0
060	Batch	.0	88.6	0	0	0	.0000	.0000	.0	.0
	System	.0	88.6	0	0	0	.0000	.0000	.0	.0
096	System	.0	88.6	0	0	1	.0000	.0019	.0	.0
099	System	.0	88.6	4	5,821	21,234	.0001	.0000	1.5	5.4
Total				104,646	536,812	735,640			138.6	189.9

Figure 9 - System report resource utilization expansion

In Figure 9, the cumulative CPU utilization for all work on the system, including the priority 20 work is 35.5%.

Workload management

To take better advantage of a single core system and maintain the balance between good response times and batch throughput, designate some UBE as low priority UBEs. To do this, you will create a new subsystem, job queue and class. The new class will be defined with a run priority that is lower than the existing batch job queues (i.e. priority 60). Specific UBEs are then configured to run in the new job queue.

The IBM Power Systems with IBM i Performance and Tuning Tips for Oracle's JD Edwards EnterpriseOne 9.0 provides complete details on how to setup and use low priority job queues. The reference to this document is in Resource section of this paper.

Summary

This white paper has covered some of the considerations for using a single-core POWER7 processor-based Power Systems™ server with IBM i for running JD Edwards EnterpriseOne software. In addition to these recommendations, you should also review the guidelines for tuning the JD Edwards EnterpriseOne HTML server and Enterprise Server. Links to these companion documents are found in the "Resources" section below.

Resources

General system tuning

- End to End Performance Management on IBM i (November 2009) http://www.redbooks.ibm.com/redbooks/pdfs/sg247808.pdf
- IBM Power Systems Performance Capabilities Reference IBM i operating system 7.1 http://www-03.ibm.com/systems/resources/systems_power_software_i_perfmgmt_pcrm_oct2011.pdf
- Performance Management for IBM System i Home Page http://www-03.ibm.com/systems/i/advantages/perfmgmt/
- IBM System i and IBM i Information Center http://publib.boulder.ibm.com/infocenter/iseries/v7r1m0/index.jsp
- IBM / Oracle Informational APARs http://www-03.ibm.com/systems/i/advantages/oracle/

General JD Edwards EnterpriseOne tuning

- IBM Power Systems with IBM i performance and tuning tips for Oracle's JD Edwards EnterpriseOne WebSphere-based HTML servers http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101777
- IBM Power Systems with IBM i Performance and Tuning Tips for Oracle's JD Edwards EnterpriseOne 9.0 http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101504

Oracle Minimum Technical Requirements

- Oracle Minimum Technical Requirements (MTRs) (userid and password required): https://support.oracle.com/CSP/ui/flash.html#tab=KBHome(page=KBHome&id=()),(page=KBNavigator&id=(bmDocType=REFERENCE&bmDocTitle=JD%20Edwards%20EnterpriseOne%20Current%20MTR%20Index&viewingMode=1143&from=BOOKMARK&bmDocDsrc=KB&bmDocID=747323.1))

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