IBM Technical Brief

IBM zEnterprise System® and System Storage Server DS8870: SAP® Bank Analyzer 8.0 AFI Current Accounts Tests

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1 Introduction

This paper documents some of the tests that we did with the AFI Current Account scenario of SAP's most recent release of Bank Analyzer (BA) - Release 8.0 (BA8). This is a continuation of and builds on our previous experiences with SAP's Bank Analyzer 8.0 AFI Loans [1] and Bank Analyzer 7.0 (BA7) [2]. It is assumed the reader is familiar with that work. We will not go into much depth on BA's functionality. However, SAP provides some of this in [3]. IBM and SAP have worked together for several years on many aspects of SAP Banking solutions for large enterprises. One example is the *SAP for Banking on System z Reference Architecture* [4].

Our test environment was DB2 10 for z/OS [5, 6, 7, 8] and z/OS 1.13. We ran on the latest zEnterprise System zEC12 [9] and System Storage Server DS8870 [10,11,12]. All this will be discussed in more detail in later sections.

These tests were not formal benchmarks.

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6 Workload and Test Background

SAP's BA offers an extremely wide set of features and functions. For this set of tests, we used a narrow set of BA functions oriented towards accounts processing to construct a workload. This was a different workload than we had for our earlier BA8 tests [1], which focused on various types of loan scenarios. For these tests, we focused on AFI current accounts scenario, without source data layer aggregation (SDA). For scenarios with very large volumes of accounts, SDA can improve elapsed time, and it should be considered.

We used generated test data, with every account having a separate business partner (a 1:1 relationship). On an average working day, for each account, one business transaction was loaded and posted. By default, there was no daily key date valuation. Most time-critical processing was for month end processing. At the end of the month, each account was processed with four business transactions (withdrawal, deposit, interest rate on deposit, and fee). For each account, one accrual was loaded into Results Data Layer (RDL).

The processing was done via SAP batch as a chain of process steps. Typically, this chain has four logical steps:

- Post External Business Transactions (PEBT): External business transactions are generally from a feeder system. However, in our case, the test data was created within our BA system. The data is read and converted from the Source Data Layer (SDL) format to the specified accounting format, before transferring to the specified accounting system. Examples of the different accounting systems/formats are the International Accounting Standard (IAS) or German Accounting Standard Handelsgesetzbuch (HGB). Then the data is posted initially to a position clearing account in financial position management.
- Update Secondary Business Transactions (USBT): The position clearing account is cleared when the secondary business transactions are updated.
- Key Date Validation (KDV): The valuation of a position for financial instruments is based on a key date, and goes through multiple calculation steps. Possible step types include amortization, fair value calculation, and distribution of valuation reserves across time, and deferred taxes. Customers can define their own types of key date valuations. An example could be changing a tax rate.
- General Ledger Connector Document Preparation (GL): To create general ledger documents, required data are extracted from the results data layer. This function checks the consistency of the general ledger documents and saves them in the persistence layer.

As a result, for these tests, our key performance indicator (KPI) metric was the total elapsed time of PEBT, USBT, KDV, and GL. The measurements we did were stress tests – not SAP certified benchmarks. We did invest some time in doing typical tuning, as discussed below. While a major goal of these measurements was to get as much throughput as possible within schedule constraints, we did not resort to "benchmark specials".

6.1 General Tuning

General tuning was similar to our previous measurements on Bank Analyzer 8.0 AFI loan scenario since we used almost the same test environment.

- NetWeaver 7.1 EHP1 to exploit 64-bit addressability with AIX 7.1.
- Optimized Latency Mode (OLM) option of the OSA-Express4S adapter to improve the elapsed time for application server to DB server communication.
- HyperPAV for the DS8870 to reduce disk I/O queuing.
- High Performance FICON for System z (zHPF) w/ multi-track support to improve efficiency of I/O resources.
- DB2 10 and System z hardware and software features including Index I/O Parallelism for Insert, Safe Query Optimization, Large 1 MB Page Support.
- DB2 striped logs.
- MAXKEEPD=64K to minimize the number of prepares.

6.2 Application Server Tuning

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- Adjusted the number of SAP instances to eight per Power 780 to increase the SAP memory pools to accommodate more parallel jobs.
- Adjusted the number of parallel batch jobs based on application server CPU consumption of the workload and the available processor capacity. This had a profound effect on the utilization of both the application server and the DB server.
- Installed AIX 7.1 to take advantage of improvements in AIX as well as its exploitation of 16 MB pages.

6.3 Database Tuning

- Identified “hot” tables using SAP transaction st04, and spread out these tables/indexes on DASD.
- Isolated these tables/indexes to unique DB2 buffer pools.
- Used larger DB2 buffer pools.
- Used member cluster for heavily inserted tables.
- Improved SQL access paths with up-to-date RUNSTATS.

The buffer pool settings were:

BP name	PGFIX	VP Pages (K)	VPSEQT [%]	VPPSEQT [%]	VPXPSEQT [%]	DWQT [%]	VDWQT [%]	VDWQT [pages]	Page steal
BP0	YES	100	80	50	0	50	5	0	LRU
BP1	NO	120	100	50	0	50	5	0	LRU
BP2	YES	4,000	80	50	0	50	5	0	LRU
BP3	YES	4,000	50	50	0	50	5	0	LRU
BP4	YES	400	80	50	0	50	5	0	LRU
BP5	YES	1,200	50	50	0	50	5	0	LRU
BP7	YES	12,000	50	50	0	50	5	0	LRU
BP8	YES	400	80	50	0	50	5	0	LRU
BP9	YES	1,200	50	50	0	50	5	0	LRU
BP12	YES	400	80	50	0	50	5	0	LRU
BP13	YES	400	50	50	0	50	5	0	LRU
BP14	YES	400	80	50	0	50	5	0	LRU
BP15	YES	400	50	50	0	50	5	0	LRU
BP40	YES	10	80	50	0	50	5	0	LRU
BP8K0	YES	800	80	50	0	50	5	0	LRU
BP8K1	YES	800	80	50	0	50	5	0	LRU
BP8K2	YES	1,600	80	50	0	50	5	0	LRU
BP16K0	YES	10	80	50	0	50	5	0	LRU
BP16K1	YES	10	80	50	0	30	5	0	LRU
BP32K	YES	15	80	50	0	50	5	0	LRU
BP32K1	YES	15	80	50	0	50	5	0	LRU
BP32K3	NO	15	80	50	0	50	10	0	LRU

Table 1: DB2 Buffer Pool Settings

The hot tables are listed below. In general, these are the largest and most heavily inserted tables. These tables are Reorder Row Format (RRF), Partition by Growth (PBG), and compressed. Many tables in BA are "generated" tables so the table names are unique to each SAP system. RDL table names begin with /1BA/HM_. The character to the left of the client number (e.g., 701 in our case) describes Header tables (H), Version tables (V), Buffer tables (B), and Data tables (_).

Table or Index Name	Table or Index	Client	Area	Object Name	Strucname	BP	Member Cluster
/1BA/HM_G3MG_701	T	701	SBA	SF		BP8K2	Yes
/1BA/HM_G3MG_701~0	I					BP7	
/1BA/HM_G3MG_701UI	I					BP7	
/1BA/HM_G3MG_701FP	I					BP7	
/1BA/HM_G3MG_701UH	I					BP7	
/1BA/HM_G3MG_701BK	I					BP7	
/1BA/HM_G3MG_701UA	I					BP7	
/1BA/HM_G3MG_701ZG	I					BP7	
/1BA/HM_G3MGV701	T	701	SBA	SF		BP4	No
/1BA/HM_G3MGV701~0	I					BP5	
/1BA/HM_G3MGV701VG	I					BP5	
/1BA/HM_G3MGH701	T	701	SBA	SF		BP4	No
/1BA/HM_G3MGH701~0	I					BP5	
/1BA/HM_G3MGH70150	I					BP5	
/1BA/HM_NYC4_701	T	701	SBA	S_FA_FPB1D		BP8	No
/1BA/HM_NYC4_701~0	I					BP9	
/1BA/HM_NYC4_701LF	I					BP9	
/1BA/HM_NYC4_701Z1	I					BP9	
/1BA/HM_NYC4B701	T	701	SBA	S_FA_FPB1D		BP8	No
/1BA/HM_NYC4B701~0	I					BP9	
/1BA/HM_NYC4B701Z2	I					BP9	
/1BA/HM_NYC4H701	T	701	SBA	S_FA_FPB1D		BP8	No
/1BA/HM_NYC4H701~0	I					BP9	
/1BA/HM_NYC4H70150	I					BP9	
/1BA/HM_NYC4V701	T	701	SBA	S_FA_FPB1D		BP8	No
/1BA/HM_NYC4V701~0	I					BP9	
/1BA/HM_NYC4V70150	I					BP9	
/1BA/HM_NYC4V701VG	I					BP9	
/1BA/HM_0IXCH701	T	701	SBA	S_KFCBD2		BP12	Yes
/1BA/HM_0IXCH701~0	I					BP13	
/1BA/HM_0IXCH70150	I					BP13	
/1BA/HM_0IXCV701	T	701	SBA	S_KFCBD2		BP12	No
/1BA/HM_0IXCV701~0	I					BP13	
/1BA/HM_0IXCV70150	I					BP13	
/1BA/HM_0IXCV701VG	I					BP13	
/1BA/HM_0IXC_701	T	701	SBA	S_KFCBD2		BP12	No
/1BA/HM_0IXC_701Z1	I					BP13	
/1BA/HM_0IXC_701~0	I					BP13	
/1BA/HM_1J3IH701	T	701	SBA	S_FPCBD2		BP14	Yes
/1BA/HM_1J3IH701~0	I					BP15	

Table or Index Name	Table or Index	Client	Area	Object Name	Strucname	BP	Member Cluster
/1BA/HM_1J3IH70150	I					BP15	
/1BA/HM_1J3IV701	T	701	SBA	S_FPCBD2		BP14	No
/1BA/HM_1J3IV70150	I					BP15	
/1BA/HM_1J3IV701VG	I					BP15	
/1BA/HM_1J3IV701~0	I					BP15	
/1BA/HM_1J3I_701	T	701	SBA	S_FPCBD2		BP14	No
/1BA/HM_1J3I_701Z1	I					BP15	
/1BA/HM_1J3I_701~0	I					BP15	
/1SGS/4F0AD302	T				_R0_SBA_____SF_ _____	BP4	Yes
/1SGS/4F0AD302~0	I					BP5	
/1SGS/4F0AD302~DEF	I					BP5	

7 Configurations

7.1 Hardware Environment

System z DB Server: Tests were performed on a single zEC12. The runs utilized one dedicated LPAR for z/OS DB2 10 with up to 8 processors and 235 GB of real storage.

Storage: One dual frame IBM System Storage Server DS8870 Model 2421-961/96E with 768 HDDs and 256 GB cache. The IBM System Storage Servers were attached to the zEC12 by sixteen long wave FICON Express8S connections. The capacity was about 164 TB of available storage capacity for database, logs, and FlashCopy sets.

The BA 8.0 database used 103 3390 Mod 54 volumes - about 5.6 TB. It had 32 active logs of 4GB size each, striped across four volumes on four different ranks.

Application Servers: One IBM Power 780 system with 64 3.9 GHz cores utilizing SMT and 512 GB memory. It had an AIX LPAR with eight SAP instances.

Network: A dedicated 10 Gb Ethernet network was used for all connections. The application server was connected via two 10 Gb Ethernet adapters through a 10 Gb Ethernet switch to the zEC12 via two OSA-Express4S adapters.

Below is a conceptual view of the test hardware and software configuration.

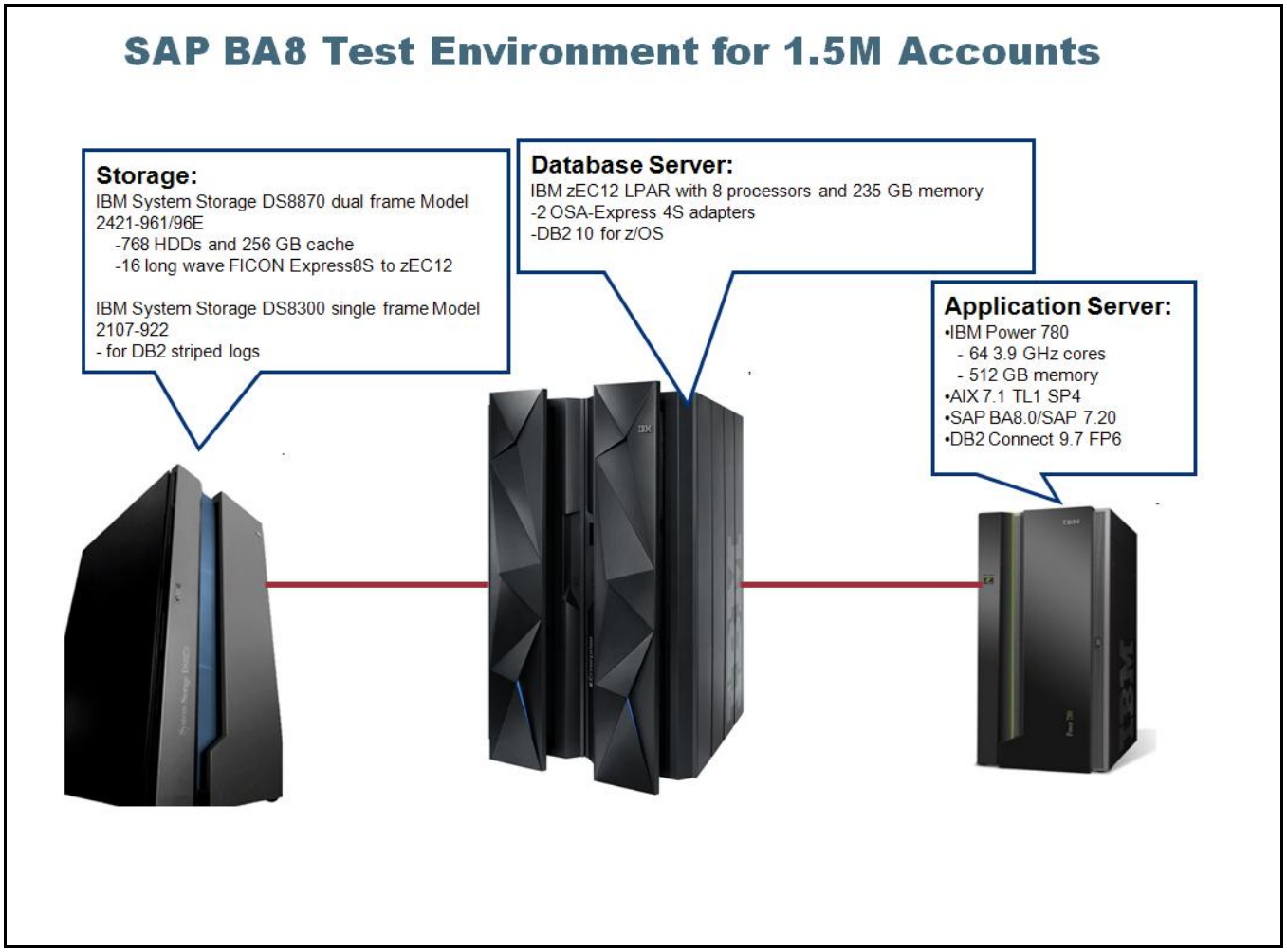

Figure 1: Conceptual View of BA8 Test Environment Configuration

7.2 Software Environment

z/OS
z/OS release 01.13.00 (R1.13)
DB2 10 dated January 2012

AIX
AIX 7.1 TL1 SP4

SAP Kernel Information
SAP Kernel : 720
Kernel Patch number : 300
DBSL Patch No. : 221
ICU Version : 4.0.1 Unicode Version 5.1
libsapu16 Version : 1.0025 Jul 6 2012 19:22:32
IBM DB2 Connect "Thin client" side: Driver for ODBC, CLI, JDBC and SQLJ - Version 9.7 FP6

SAP Application Levels
SAP EHP1 for SAP NetWeaver 7.1

Software Component	Release	Level	Highest Support Package	Short Description of Software Component
SAP_ABA	711	0010	SAPKA71107	Cross-Application Component
SAP_BASIS	711	0010	SAPKB71107	SAP Basis Component
PI_BASIS	711	0010	SAPK-71107INPIBASIS	Basis Plug-In
ST-PI	2008_1_710	0007	SAPKITLRE4	SAP Solution Tools Plug-In
SAP_BW	711	0010	SAPKW71107	SAP Business Warehouse
FINBASIS	700	0019	SAPK-70016INFINBASIS	Financial Basis
SEM-BW	700	0019	SAPK-70009INSEMBW	SEM-BW 700: Add-On Installation
BI_CONT	711	0002	SAPK-71102INBICONT	Business Intelligence Content
FSAPPL	400	0004	SAPK-40001INFSAPPL	SAP Banking Services
ST-A/PI	01N_710BCO	0001	SAPKITAB8H	Servicetools for other App./Netweaver200

Table 2: SAP Application Levels

As can be seen above, BA consists of SAP's core banking, BI Content, and BW. BA requires Unicode, and the System z has hardware data compression. As a result, hardware data compression was used extensively.

SAP CSS Notes Applied
1704783: fix memory leak in detail log
1673941: memory leak when reading aggregated RDL results
1689312: KDV redundant selects on flow table
1670331: filter variants to reduce logging
1237311: fix full table scan when processing transactions (index on FPO characteristics)

8 Test Results

During the course of this effort, many runs were performed. Some were to get familiar with the environment and the workload. Some were for debugging. It is beyond the scope of this paper to show them all.

8.1 AFI Current Account Results

Subsequent sections show each measurement as well as some detailed measurement data. The following figure shows the summary of results of six measurement points, scaling from 32 to 128 parallel jobs, and the demonstration of utilizing zIIP, and optimizing the DB server configuration.

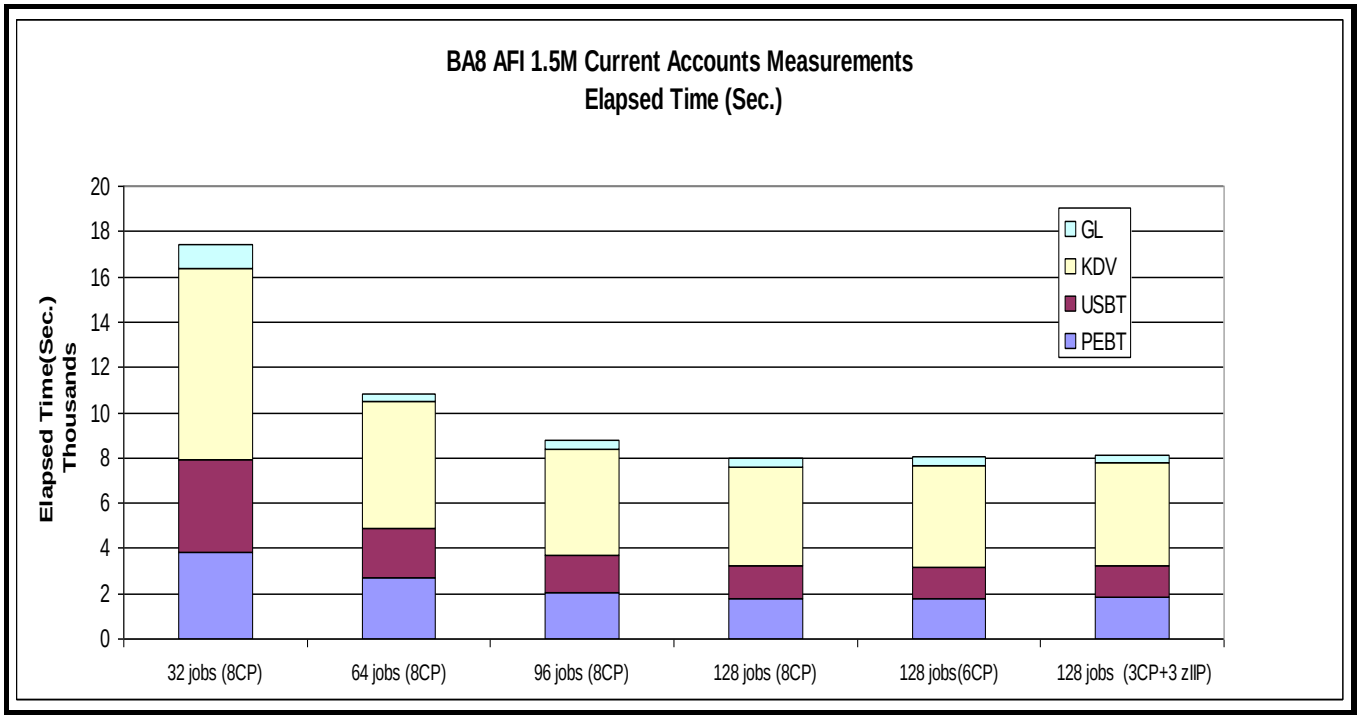

Figure 2: 1.5 Million Accounts Test Results Summary

8.1.1 BA8 AFI 1.5 Million Accounts – 32 Jobs with 8 CP Results

We started the first sequence of measurements with a zEC12 SAP DB server having 8 general processors (CPs) and 32 parallel batch jobs.

Runid	Process Step	# of Batch Jobs	Elapsed Time (sec)	DB Server	App. Server	DB Server Util.	App. Server Util.	DB I/O/Sec. (Peak 5M Avg)
S30503A1	Post External (PEBT)	32	3,801	2827-708	p780-64 core	18%	22%	14,414
S30503A2	Update Secondary (USBT)	32	4,088	2827-708	p780-64 core	16%	19%	13,198
S30503A3	Key Date Valuation (KDV)	32	8,465	2827-708	p780-64 core	12%	21%	12,100
S30503A4	GL Connector (prep)	32	1,047	2827-708	p780-64 core	26%	1%	1,507
	TOTAL (sec)		17,401					
	TOTAL (hour)		**4.8**					

Table 3: BA8 AFI 1.5 Million Accounts – 32 Jobs with 8 CP Results

8.1.2 BA8 AFI 1.5 Million Accounts – 64 Jobs with 8 CP Results

This measurement is almost the same as the previous one, except we increased the number of parallel jobs from 32 to 64, and the maximum number of parallel jobs for GL step was limited at 48 by SAP code.

Runid	Process Step	# of Batch Jobs	Elapsed Time (sec)	DB Server	App. Server	DB Server Util.	App. Server Util.	DB I/O/Sec. (Peak 5M Avg)
S30510A1	Post External (PEBT)	64	2,690	2827-708	p780-64 core	26%	33%	21,715
S30510A2	Update Secondary (USBT)	64	2,193	2827-708	p780-64 core	29%	35%	24,297
S30510A3	Key Date Valuation (KDV)	64	5,616	2827-708	p780-64 core	22%	40%	22,148
S30606A1	GL Connector (prep)	48	347	2827-708	p780-64 core	49%	1%	1,892
	TOTAL (sec)		10,846					
	TOTAL (hour)		**3.0**					

Table 4: BA8 AFI 1.5 Million Accounts – 64 Jobs with 8 CP Results

8.1.3 BA8 AFI 1.5 Million Accounts – 96 Jobs with 8 CP Results

In this measurement, to get better total elapsed time, we increased the number of parallel jobs again from 64 to 96.

Runid	Process Step	# of Batch Jobs	Elapsed Time (sec)	DB Server	App. Server	DB Server Util.	App. Server Util.	DB I/O/Sec. (Peak 5M Avg)
S30513A1	Post External (PEBT)	96	2,038	2827-708	p780-64 core	37%	46%	25,066
S30513A2	Update Secondary (USBT)	96	1,633	2827-708	p780-64 core	43%	50%	34,891
S30513A3	Key Date Valuation (KDV)	96	4,729	2827-708	p780-64 core	33%	59%	30,479
S30606A1	GL Connector (prep)	48	347	2827-708	p780-64 core	49%	1%	1,892
	TOTAL (sec)		8,747					
	TOTAL (hour)		**2.4**					

Table 5: BA8 AFI 1.5 Million Accounts -- 96 Jobs with 8 CP Results

8.1.4 BA8 AFI 1.5 Million Accounts – 128 Jobs with 8 CP Results

In this measurement, again, we increased the number of parallel jobs from 96 to 128, to get better elapsed time.

Runid	Process Step	# of Batch Jobs	Elapsed Time (sec)	DB Server	App. Server	DB Server Util.	App. Server Util.	DB I/O/Sec. (Peak 5M Avg)
S30514A1	Post External (PEBT)	128	1,802	2827-708	p780-64 core	42%	56%	26,381
S30514A2	Update Secondary (USBT)	128	1,451	2827-708	p780-64 core	52%	62%	37,649
S30514A3	Key Date Valuation (KDV)	128	4,361	2827-708	p780-64 core	40%	71%	36,831
S30606A1	GL Connector (prep)	48	347	2827-708	p780-64 core	49%	1%	1,892
	TOTAL (sec)		7,961					
	TOTAL (hour)		**2.2**					

Table 6: BA8 AFI 1.5 Million Accounts – 128 jobs with 8 CP results

8.1.5 BA8 AFI 1.5 Million Accounts – 128 Jobs with 6 CP Results

In this measurement, we stayed at 128 parallel jobs, and we optimized the zEC12 SAP DB server configuration by changing from 8 to 6 general processors (CPs), while still maintaining the same total elapsed time from the previous measurement.

Runid	Process Step	# of Batch Jobs	Elapsed Time (sec)	DB Server	App. Server	DB Server Util.	App. Server Util.	DB I/O/Sec. (Peak 5M Avg)
S30529A1	Post External (PEBT)	128	1,793	2827-706	p780-64 core	53%	56%	25,959
S30529A2	Update Secondary (USBT)	128	1,361	2827-706	p780-64 core	70%	64%	40,314
S30529A3	Key Date Valuation (KDV)	128	4,518	2827-706	p780-64 core	55%	70%	36,730
S30605A1	GL Connector (prep)	48	393	2827-706	p780-64 core	59%	1%	1,475
	TOTAL (sec)		8,065					
	TOTAL (hour)		**2.2**					

Table 7: BA8 AFI 1.5 Million Accounts – 128 Jobs with 6 CP Results

8.1.6 BA8 AFI 1.5 Million Accounts – 128 jobs with 3 CP + 3 zIIP Results

In this measurement, we changed the zEC12 SAP DB server configuration to utilize zIIP engines by having three general processors (CPs) and three zIIPs, while still maintaining the same total elapsed time.

Runid	Process Step	# of Batch Jobs	Elapsed Time (sec)	DB Server	App. Server	Avg. DB Server Util.	App. Server Util.	DB I/O/Sec. (Peak 5M Avg)
S30603A1	Post External (PEBT)	128	1,831	2827-703+3 zIIPs	p780-64 core	54%	56%	21,755
S30603A2	Update Secondary (USBT)	128	1,432	2827-703+3 zIIPs	p780-64 core	68%	61%	36,047
S30603A3	Key Date Valuation (KDV)	128	4,503	2827-703+3 zIIPs	p780-64 core	54%	69%	37,464
S30605A3	GL Connector (prep)	48	332	2827-703+3 zIIPs	p780-64 core	64%	1%	756
	TOTAL (sec)		8,098					
	TOTAL (hour)		**2.2**					

Table 8: BA8 AFI 1.5 Million Accounts – 128 jobs with 3CP + 3 zIIP Results

8.2 Detailed Data for 3 CP + 3 zIIP

Listed below are some more detailed measurement results for 3 CP + 3 zIIP measurement. The first two tables (Tables 9 and 10) show metrics from SAP.

Parent Batch: Process Step	Elapsed Time	App. Server CPU Time	DBREQ Time	RFC Time	ENQ Time
PEBT	1,831	25	128	76	33
USBT	1,432	42	176	53	23
KDV	4,503	28	2,624	75	34
GL	332	2	48	8	1
Total (sec)	8,098				
Total (hr)	**2.2**				

Table 9: 3 CP + 3 zIIP Parent Batch Detailed Data

Note that the child batch elapsed times (Table 10) should be close to the parent batch elapsed time (Table 9). The KDV step has largest difference. Please refer to page 23 for an explanation.

Child Batch: Process Step	# of Child Batches	Elapsed Time	App. Server CPU Time	DBREQ Time	RFC Time	ENQ Time
PEBT	128	1,695	406	722	0	5
USBT	128	1,257	351	549	0	5
KDV	128	1,930	652	609	0	3
GL	48	313	0.1	313	0	0

Table 10: 3 CP + 3 zIIP Child Batch Detailed Data

This table shows data from the application server. The data comes from VMSTAT and SAP statistics.

Process Step	# of Child Batches	Avg. CPU Util.	30 Sec. Peak CPU Util.	30 Sec. Peak Active Memory (GB)	Peak IOWAIT
PEBT	128	56%	58%	107.2	0%
USBT	128	61%	63%	109.6	0%
KDV	128	69%	74%	107.9	0%
GL	48	1%	1%	108.8	0%

Table 11: 3 CP + 3 zIIP Application Server Detailed Data

This table shows data from the DB server, which comes from RMF and Tivoli Omegamon XE for DB2.

Process Step	CPU Util.	zIIP Util.	BPOOL Size	BPOOL Hit Ratio	5 Min. Peak I/O Rate (/sec)	AVG Reads (/sec)	AVG Prefetch Reads (/sec)	AVG Async. Writes (/sec)	5 Min. Peak Log Writes (/sec)	zHPF
PEBT	54%	55%	127 GB	96.50%	21,755	10,016	1,009	8,728	1,793	99%
USBT	56%	80%	127 GB	70.40%	36,047	19,955	12,706	346	680	99%
KDV	47%	61%	127 GB	97.92%	37,464	8,586	4825	2424	866	99%
GL	64%	65%	127 GB	99.52%	756	539	123	1	10	99%

Table 12: 3 CP + 3 zIIP DB Server Detailed Data

Below are some graphs showing the processor utilizations and I/O rates over time of the different steps. We only collected zIIP data over time for the first three steps. The y-axis scales are the same for all steps. However, this is not the case for the x-axis as it is a function of the elapsed time, which varied considerably depending on the step.

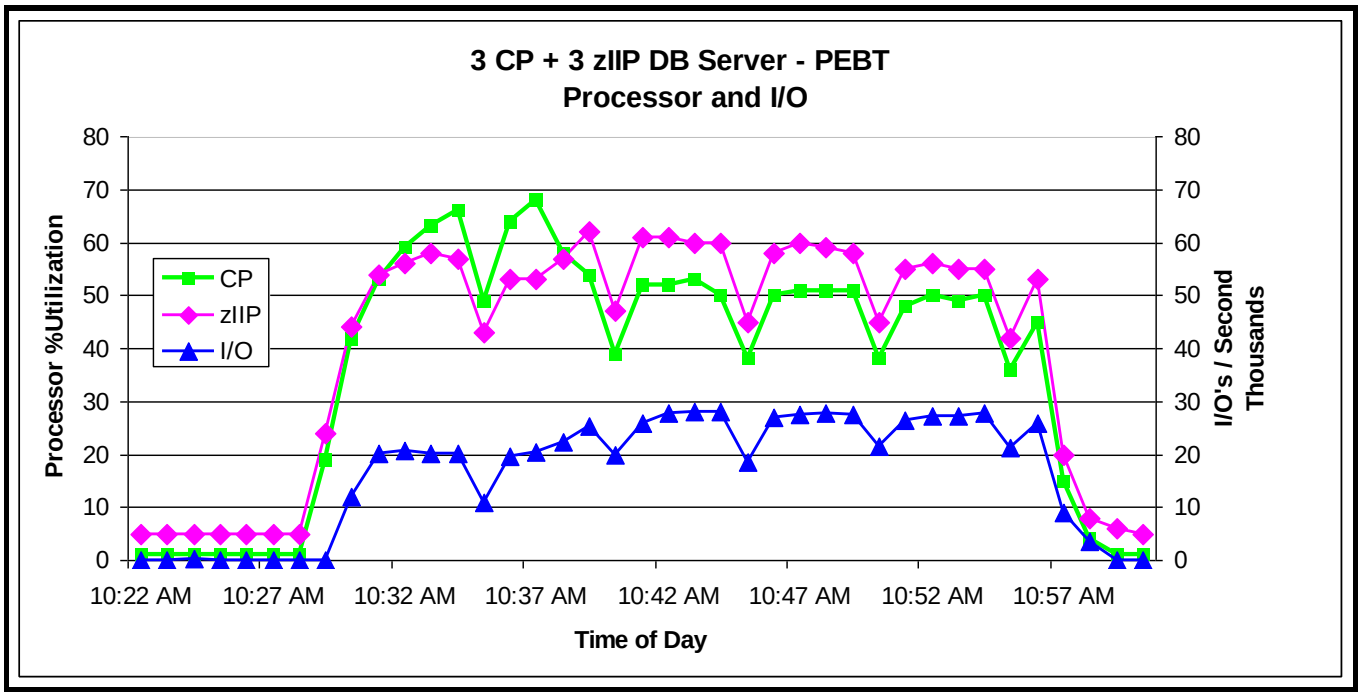

Figure 3: 3 CP + 3 zIIP PEBT DB Server Processor Utilization and I/O rates

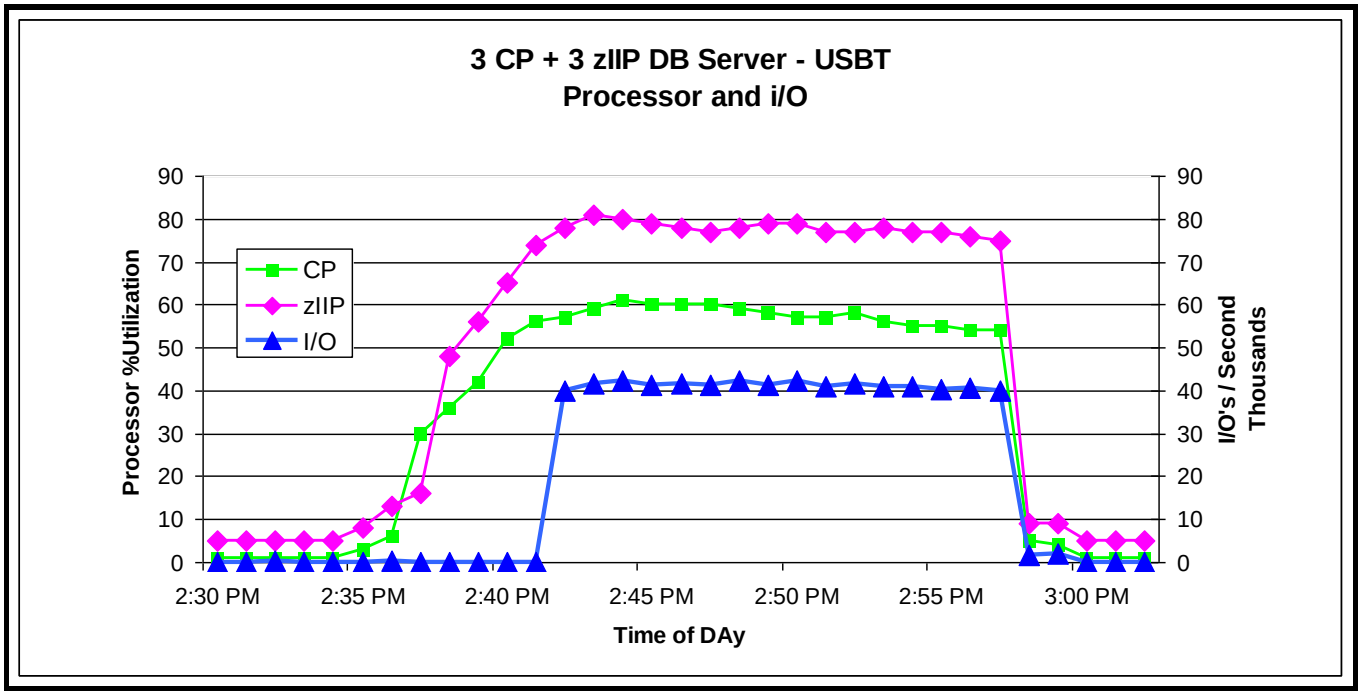

Figure 4: 3 CP + 3 zIIP USBT DB Server Processor Utilization and I/O rates

The KDV step has the longest elapsed time of all the steps [Figure 5]. As a result, the x-axis is not to the same scale as other figures. Note that the first part of the graph shows high utilization, and the second part shows low utilization. In the first part, there were 128 batch jobs dispatched to process the KDV step in parallel. After all 128 jobs completed, one batch job (parent task) remained to perform the final processing of KDV step. This is why the parent elapsed time is so much more than the child batch time. SAP has planned an enhancement to improve this in the future.

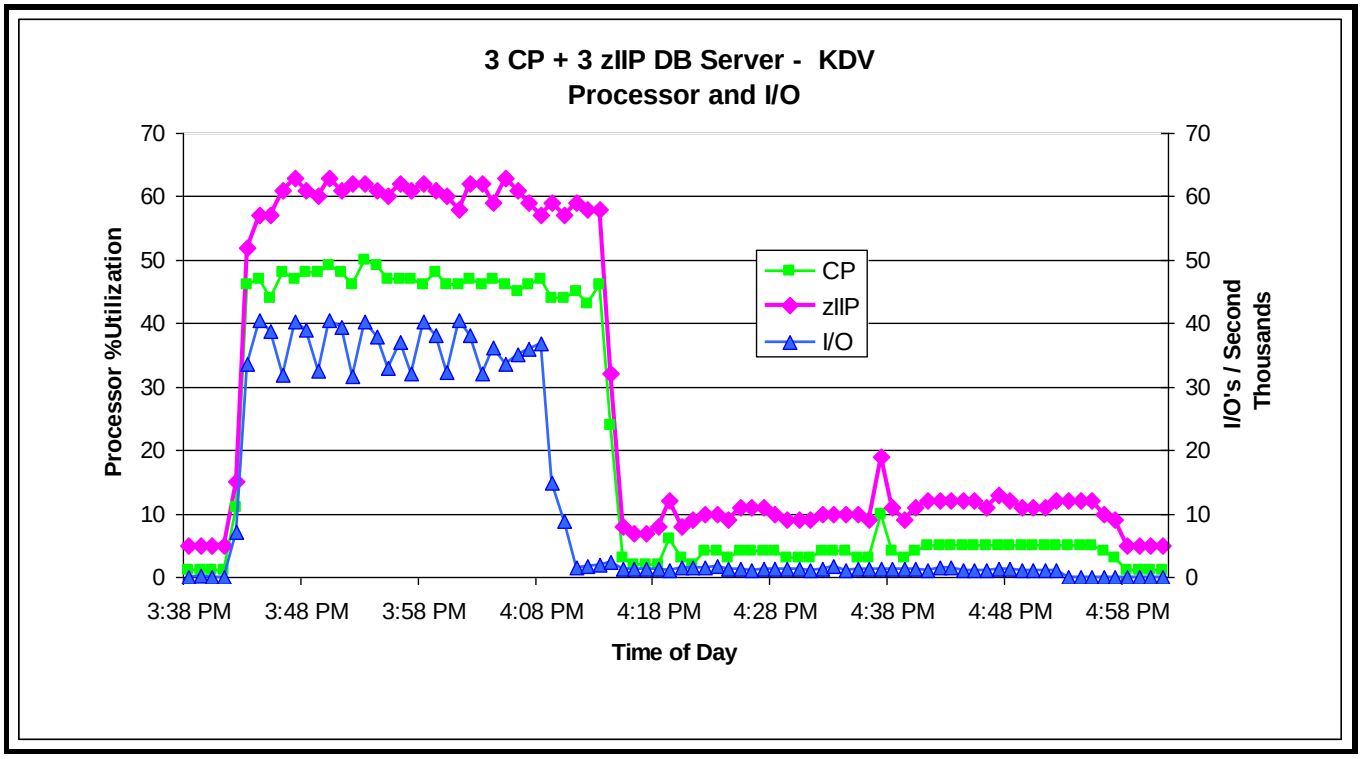

Figure 5: 3 CP + 3 zIIP KDV DB Server Processor Utilization and I/O rates

Shown below is a similar graph for GL. However, since we did not collect the zIIP information in one minute intervals for this step, the graph shown below is from the 6 CP run. As shown in Table 12, the zIIP utilization was slightly higher than the general CPs. We would expect a 3 CP + 3 zIIP graph to have a similar plot.

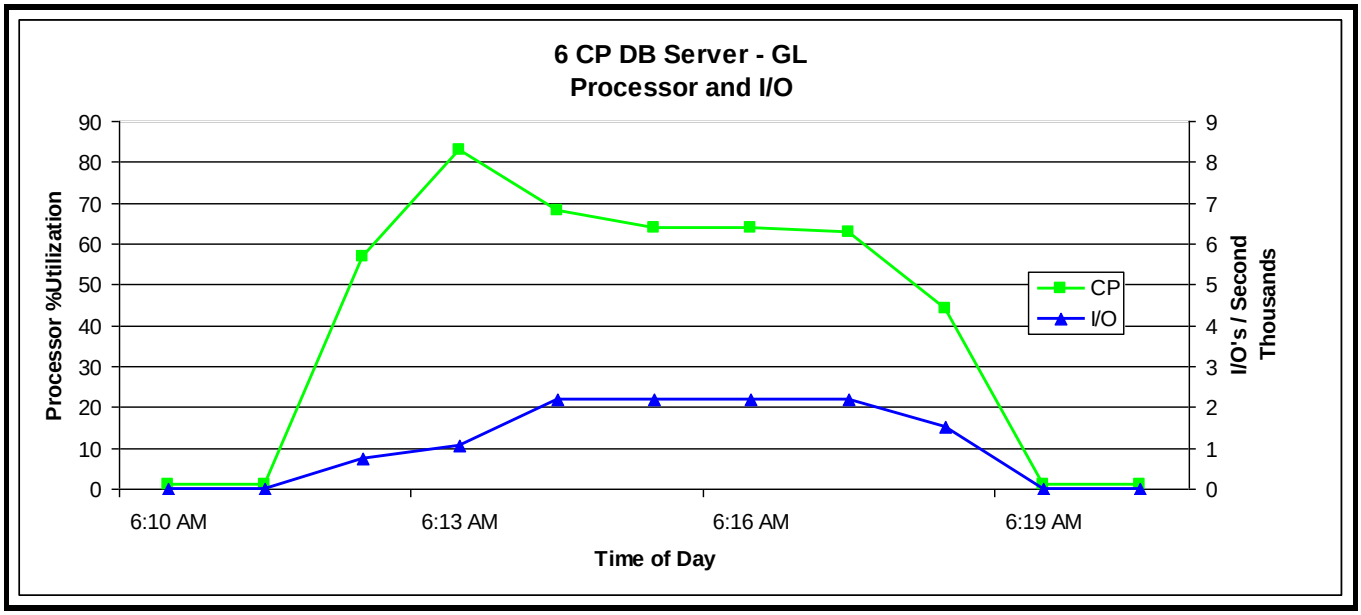

Figure 6: 6 GL DB Server Processor Utilization and I/O rates

9 Analysis

Once again, while a major goal of these measurements was to get as much throughput as possible in the limited time available, we did not resort to "benchmark specials". Discussed below are several analysis aspects.

Scaling by Varying Number of Parallel Jobs

Total elapsed time to process 1.5 million accounts was reduced from 4.8 hours to 2.2 hours, more than half, by increasing the number of parallel jobs from 32 to 128 jobs.

Database Server

The first four measurement runs used 8 CPs for the DB Server. To optimize the DB2 server configuration, we reduced the number of processors to 6 CPs. Then we did one measurement with 3 CPs + 3 zIIPs, in an attempt to test a more economical DB server configuration, and demonstrate zIIPs. Using zIIPs can reduce cost.

zIIP Exploitation

Analysis, based on data shown in "Table 12: 3 CP + 3 zIIP DB Server Detailed Data" on page 20, indicates that the percent redirect to zIIPs for the entire LPAR ranged, depending on the step, from 55% to 80%. This is probably a little higher than a typical production environment. This is because we did not run some of the typical functions customers use for the care and feeding of a real production database (e.g., HSM).

Application Server

The application server processing in the AFI account scenario was not as intensive as in the AFI loan scenario. We observed this by determining the CPU cores for each step normalized for utilization and elapsed time. When looking at all four steps combined, the application server cores were 91% and the DB server cores were only 9% of the total used CPU cores; as compared to AFI loan scenario, 96% and 4%, respectively. Essentially, the AFI current account scenario has a core ratio of DB to application server typical as most other SAP application workloads.

The AFI loan scenario is much more complex because of the huge amount of different conditions (ie., full disbursement, partial disbursements, interest calculation, amortization, charges, and discounts). In this test scenario with the AFI current accounts, we only have a limited set of conditions (ie., deposit, withdrawal, and charges). In addition, in the AFI loan scenario, a cash flow has to be calculated for the whole fixed interest rate period. In the AFI current account scenario, we do not have a cash flow generation.

I/O Profile

The BA8 AFI current account scenario has significant I/O rates. One step, Update Secondary (USBT), had a peak 5 minute I/O rate of 40,314 I/Os per second as compared to 24,900 I/Os per second for 15 minutes in the AFI loan scenario. When normalized for utilization, this is more than twice our rough rule of thumb peak I/O rate for this DB server. This means that customers considering BA should have a particularly robust I/O configuration for the DB server. An example would involve large amounts of main memory, high-speed FICON adapters, and a particularly strong storage subsystem.

One factor that can significantly improve I/O performance and FICON adapter efficiency is zHPF. DB2 in an SAP environment is typically a good exploiter of zHPF. Further, FICON Express8S is particularly efficient processing zHPF requests. The BA8 AFI account scenario continues that tradition. In our measurements, we saw 99+% exploitation in all the steps. A second factor in improving I/O performance is to have a storage subsystem that can deliver good response time. In our measurements, we saw each step's peak I/O rate interval had a excellent average DASD response times - 0.4 to 1.5 milliseconds.

10 Conclusions

We can draw three main conclusions from these BA measurements:

- Application server resources are key to overall elapsed time performance.
- BA has high I/O rates.
- Utilizing zIIP can be cost effective.

Should even more throughput be needed, there are further options. For example, adding more application servers to the current configuration could help. Similarly, DB scalability and its near continuous availability could be enhanced with a data sharing Parallel Sysplex.

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