IBM

IBM Technical Brief

IBM System z®:
SAP® for Insurance Tests

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1 Introduction

IBM participates in several partnership programs with SAP AG. As part of this partnership, IBM and SAP establish co-innovation projects in order to optimize the use of technologies by the SAP enterprise applications. This benefits SAP because it broadens the exposure of their applications and personnel to different environments and gives them the opportunity to try new features and functions and improve their solutions. IBM products and personnel similarly benefit as SAP applications are becoming part of IBM's continuous testing and improvement of its products.

Both IBM and SAP view the insurance industry as particularly important. As evidence of this, we have together developed a reference architecture document for System z with SAP [1]. This paper describes several tests the companies jointly performed with IBM System z, DB2 for z/OS and the SAP for Insurance application [2, 3].

The focus of the IBM efforts and this paper was on the interactions of the application with the IBM supplied infrastructure. Infrastructure examples are servers, storage subsystem, operating systems, relational database, and associated items. While SAP optimized their SAP for Insurance application behavior during these tests, the IBM team focused on the infrastructure.

These tests were not performance measurements nor were they formal benchmarks. Our goal was to understand the workload behavior and learn for further optimizations. While we did report several performance related metrics, these tests were more in the nature of stress tests. There was very limited exposure of the application to the test environment. Sometimes there were just a couple tests. In addition, there were relatively low business volumes attempted. As a result, there was very limited infrastructure tuning, investigation of performance bottlenecks, and investigation of how to scale up the volumes. Further, we ran on systems that are two generations old with the associated limitations of features and functions. For example, the DB Server's System z9 used was two generations down level from today's zEnterprise System. This resulted in relatively slow communication speeds for networks and disks compared to the current generation with no capability to use features like High Performance FICON for System z (zHPF) [4, 5]. However, we used current versions of z/OS, DB2 for z/OS for testing.

All that being said, this project enabled SAP to enhance this application with several functions, features, and extensions to run more efficiently from a database as well as application server perspective.

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The results shown are based on specific workloads run in a somewhat controlled environment. However, these tests were not intended to be rigorous performance measurements. The workloads changed and there was little, if any, chance to tune the workloads because of schedules. The actual throughput that any user will experience will vary considerably from these results. Therefore, no assurance can be given that an individual user will achieve throughput equivalent to the performance stated here.

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4 Feedback

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5 Acknowledgements

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6 Workload and Test Background

We tested three SAP for Insurance core applications:
- Financial Services – Policy Management (FS-PM)
- Financial Services – Collections and Disbursements (FS-CD)
- Financial Services – Claims Management (FS-CM)

As mentioned in Section 1, "Introduction", on page 4, we focused on application interactions with the infrastructure. We did not run an SAP Standard Application Benchmark. SAP's insurance offerings have many other possible applications and variations that we did not test. These three applications were selected because: FS-PM is the core SAP for Insurance application portfolio, FS-CD is the most popular SAP insurance application run by customers today, and recently FS-CM is getting more traction. We did not tune these tests as one might for a benchmark or performance test or even as a customer might. For example, because of the modest hardware environment, we did no virtual storage tuning with DB2 9.

For these tests, we had two separate SAP systems. Two separate SAP systems is a fully supported configuration and was an artifact of our install sequence. It is not uncommon for customers to have two SAP systems for these applications since this can provide more flexibility and easier scaling. The SAP System IDs (SIDs) were HR7 and INS. HR7 ran FS-PM. INS ran FS-CD and FS-CM. Each SID had its own DB2 system but both resided in the same z/OS LPAR. Similarly, each SID has its own instance on each Application Server. We had both SIDS and databases running for all tests. Integration and communication between the two SAP systems was through Remote Function Calls (RFCs). Below is an SAP conceptual view.
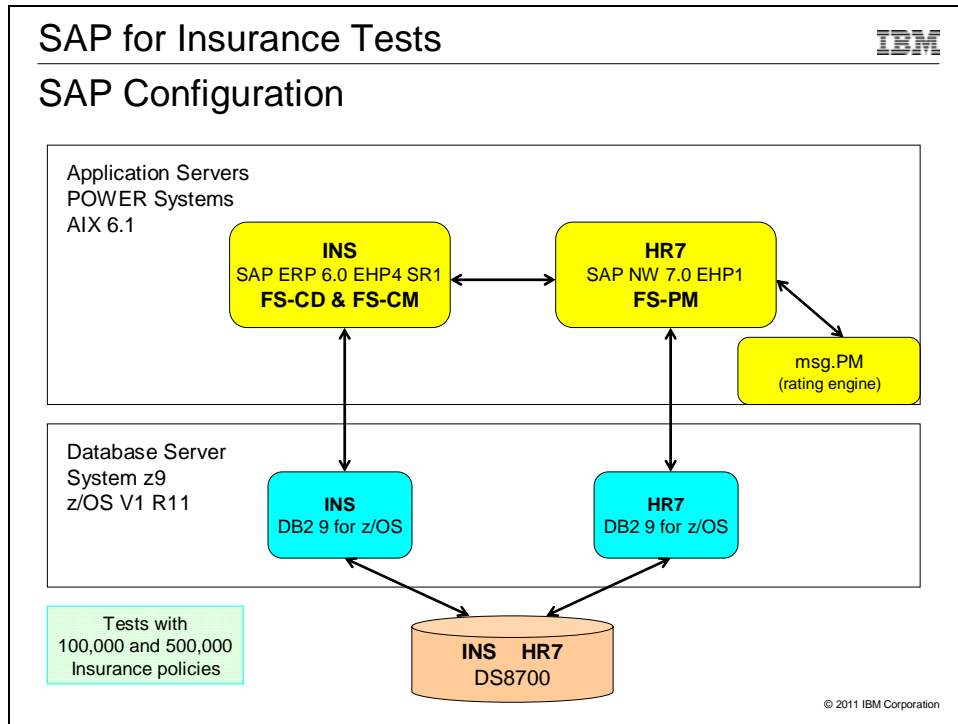
Figure 1: SAP Conceptual View of Insurance Test Environment Configuration

The volumes and metrics used for these tests represent realistic insurance company key performance indicators and situations.

- The metric of throughput (i.e., business volumes) for FS-PM and FS-CD was policies processed per unit time. Initially each test processed 100,000 policies but we later redid all runs with 500,000 policies.
- The metric of throughput for FS-CM was claims processed per unit time.

Keeping in mind our focus on the infrastructure, and not the application functional level, here are some short summaries of the application functions. The results of the tests are in Section 8, "Test Results" on page 11.

6.1   Financial Services – Policy Management (FS-PM)

FS-PM handles all aspects of policies – from product development to policy application management, issuance, modification, and reporting. It can run standalone or integrated with other applications like FS-CD and FS-CM. It can handle standard or very complex life, property, and casualty policies. We ran tests of the different policy types to reflect this.

FS-PM utilized, via RFCs, special bolt-on code called msg.PM to calculate premiums and extensions of contracts. Based on some initial experimentation, msg.PM was installed on two of the five application servers (see Figure 1 and Figure 2, on 7 and page 9 respectively). However, as described in Section 9.2, "Comparing FS-PM 500K Tests to 100K" on page 15, this application was significantly enhanced during the course of the tests and probably we could have managed to run it with only one msg.PM server.

IBM System z: SAP for Insurance Tests

6.2   Financial Services – Collections and Disbursements (FS-CD)

FS-CD manages premium billing with multiple payment techniques and plans for policyholders, brokers, agents, and business partners. It integrates with accounting systems as well as providing centralized views for management and analysis. This is a mature SAP for Insurance application that was already pretty well optimized by SAP.

6.3   Financial Services – Claims Management (FS-CM)

FS-CM automates and manages the entire claims process. It is integrated with FS-PM and FS-CD as well as external service providers such as appraisers. It provides both internal and external reporting, analytics and workflow management.

7   Configurations

7.1   Hardware Environment

System z DB Server: Tests were performed on a single z9 Enterprise Class Model S38 with a total of 128 GB installed. The tests utilized one dedicated LPAR for z/OS DB2 9 with 16 processors and 64 GB. This represents about 10,500 SAPS using Business Suite 7 and Unicode.

Storage: IBM System Storage Server DS8700 Model 2421-941 with 128 HDDs and 128 GB cache. The IBM System Storage Server was attached to the z9 by eight long wave FICON Express4 connections. The capacity was about 26 TB of available storage capacity for database, logs and FlashCopy sets.

As discussed in Section 6, "Workload and Test Background" on page 6, two SAP SIDs were used in these tests. The HR7 SID was allocated about 1.3 TB. The INS SID had 0.3 TB allocated. Each SID had two non-parallel logs on a dedicated volume. This is consistent with a relatively modest test system.

Application Servers: We used five application servers. They were System p 550 POWER6 8204-E8A servers each with eight 5.0 GHz processor cores using SMT and 128 GB of memory. These five servers represent about 85,000 SAPS using BS7 and Unicode.

Network: Gigabit Ethernet networks were used for all connections. The application servers were connected via a 10 Gigabit Ethernet switch to the z9 via two Open System Adapters (OSA) OSA-Express2 adapters. Each of these adapters used one port connected to the DB2 LPAR.

 Below is a conceptual view of the configuration.

SAP® for Insurance IBM System z Test Environment Configuration

2421-941 w/ 8 16-packs of 15K RPM 300 GB HDD drives; Raid 5; 128 GB regular cache & 4 GB non-volatile storage (NVS); Capacity: 488 3390 mod 54 volumes (~26 TB)

IBM System Storage Server Model DS8700: 2421-941

(database, logs, FlashCopy sets)

8 Long Wave FICON Express4 connections

z9 Enterprise Class Model S38
128 GB memory

System z DB Server

Dedicated LPAR
16 General CPs,
64 GB memory

DB2 9

(Provides ~ 10,500 SAPS)

Hardware:
SAP Database Server:
z9 Enterprise Class S38;
One dedicated z/OS LPAR
w/ 16 dedicated CPs
& 64 GB central memory;

Software:
zOS 01.11.00
DB2 9 dated Aug 2010

OSA-Express2 adapters

10 Gigabit Ethernet Switch

Five Application Servers:
Four p550 POWER6 8204-E8As regular application servers
- Each w/ eight 5.0 GHz processor cores using SMT & 128 GB of memory
One p550 POWER6 8204-E8A Central Instance
- w/ eight 5.0 GHz processor cores using SMT & 128 GB of memory

Each App Server has:
- DB2 Connect v9.1 FP8 "Thin" client
- SAP EHP1 for SAP NW 7.1, kernel 7.11 patch no. 67
- AIX 6.1 oslevel -s 6100-03-01-0921

Five application servers provide ~ 85,000 SAPS
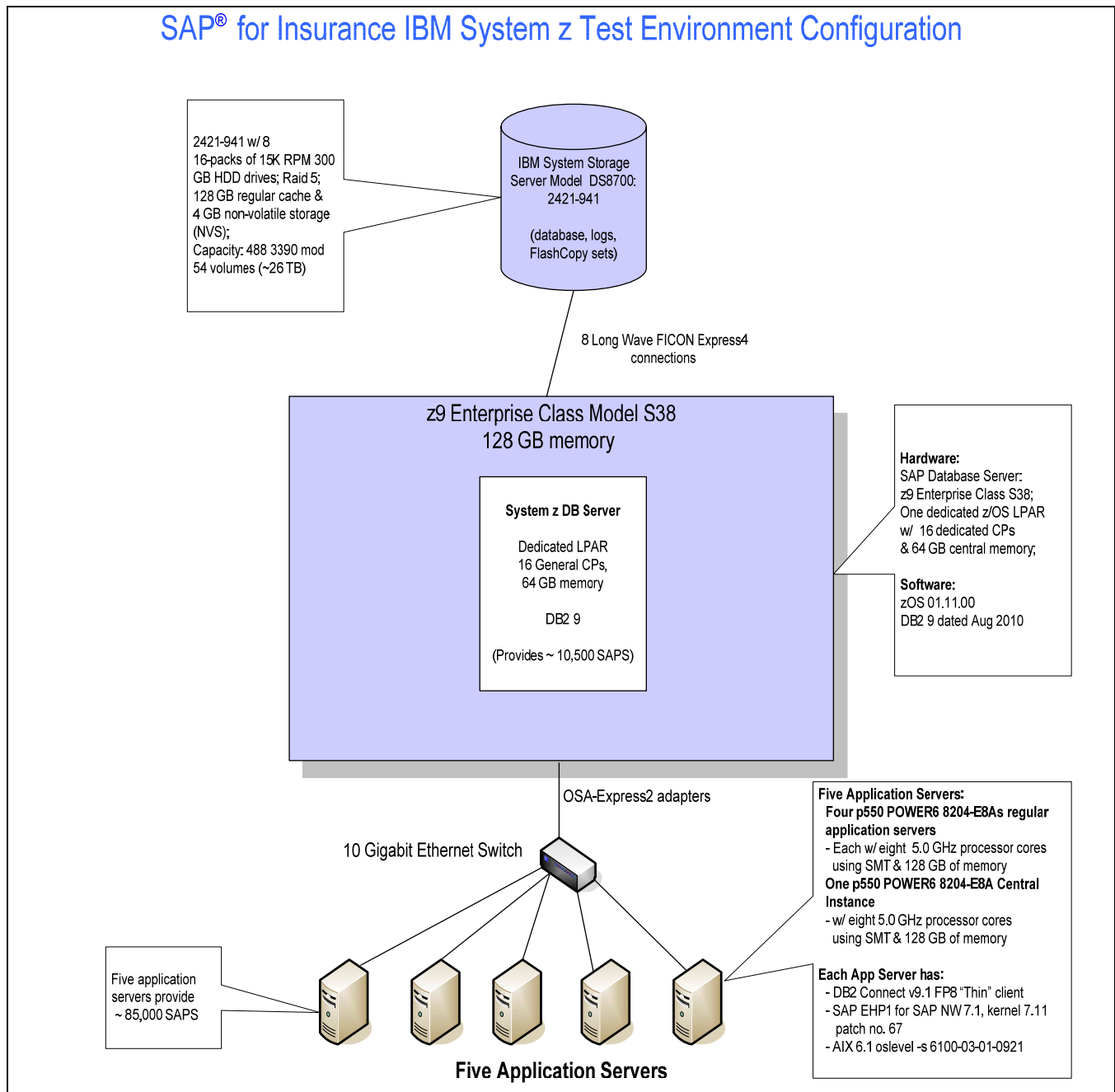
Five Application Servers

Figure 2: Hardware Conceptual View of Insurance Test Environment Configuration

7.2   Software Environment

See Figure 1, "SAP Conceptual View of Insurance Test Environment Configuration" on page 7 for a high-level view.

z/OS
z/OS release 01.11.00 (R1.11)
DB2 9 dated August 2010
IBM DB2 Connect "Thin client" side: As mentioned on page 6, there were two SIDS used for these tests.

- HR7 SID: DB2 Connect v9.1.0.5 Fix Pack 5.
- INS SID: DB2 Connect v9.5.0.3 Fix Pack 3a.

AIX
AIX 6.1
oslevel -s
6100-03-01-0921

SAP Application Levels
HR7 SID
SAP NetWeaver 7.0 EHP1

Software Component	Release	Level	Support Package	Description
SAP_ABA	701	0004	SAPKA70104	Cross-Application Component
SAP_BASIS	701	0004	SAPKB70104	SAP Basis Component
PI_BASIS	701	0004	SAPK-70104INPIBASIS	Basis Plug-In
SAP_BS_FND	701	0001	SAPK-70101INSAPBSFND	SAP Business Suite Foundation
SAP_BW	701	0004	SAPKW70104	SAP Business Warehouse
WEBCUIF	700	0000	-	SAP WEBCUIF 700
FSPM	500	0001	SAPK-50001INFSPM	FS-PM Policy Management
MSGPMCON	100	0003	SAPK-10003INMSGPMCON	msg.PM Connection

Table 1: HR7 SID SAP Application Levels

INS SID
SAP ERP 6.0 EHP4 Support Release1

Software Component	Release	Level	Support Package	Description
SAP_BASIS	701	0003	SAPKB70103	SAP Basis Component
SAP_ABA	701	0003	SAPKA70103	Cross-Application Component
PI_BASIS	701	0003	SAPK-70103INPIBASIS	Basis Plug-In
ST-PI	2008_1_700	0000	-	SAP Solution Tools Plug-In
SAP_BW	701	0003	SAPKW70103	SAP Business Warehouse
SAP_BS_FND	701	0002	SAPK-70102INSAPBSFND	SAP Business Suite Foundation
SAP_AP	700	0015	SAPKNA7015	SAP Application Platform
WEBCUIF	700	0002	SAPK-70002INWEBCUIF	SAP WEBCUIF 700
SAP_APPL	600	0015	SAPKH60015	Logistics and Accounting
FINBASIS	600	0015	SAPK-60015INFINBASIS	Fin. Basis
EA-FINSERV	600	0015	SAPKGPFD15	SAP Enterprise Extension Financial Services
INSURANCE	600	0015	SAPK-60015ININSURANC	SAP Insurance

Table 2: INS SID SAP Application Levels

8 Test Results

During the course of this effort many tests 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. In general, these tests were not specifically tuned as one might with a real benchmark – or even a production system.

Listed below are the test results selected as being the most useful, given the time constraints of this effort. The tests will be discussed more in Section 9, "Analysis", on page 15.

For each test, we report the test duration, average utilization of the DB Server, average utilization of all the Application Servers, average DB I/O rates, average OSA data rates, and, for FS-PM, an implied average CPU utilization of msg.PM. This implied utilization is computed by subtracting the average Dialog process utilization for the servers running with msg.PM. As this is an implied metric, and not directly measured, special care needs to be applied when interpreting these results.

8.1 Financial Services – Policy Management (FS-PM) Results

Below are listed the test results. Each row represents a test of 500,000 policies of a specific type.

Policy type	Duration	Avg. CPU DB Server	Avg. CPU for 5 Apps Servers	Avg. DB IO/sec	Avg. OSA bytes /sec	Implied Avg. CPU for Each msg.PM
Life Capital	1 hr 31min (91 min)	25.92%	60.84%	3,233	20,049,532	11.7%
Life Annuity	1 hr 24 min (84 min)	25.54%	49.70%	3,112	24,059,773	8.9%
Life Link Unit	2 hr 22 min (142 min)	17.38%	61.48%	2,252	15,539,373	13.8%
P&C Liability	2 hr 11 min (133 min)	22.00%	50.38%	3,030	18,225,789	9.3%
P&C Luggage	54 min	24.40%	43.48%	1,883	24,710,999	3.6%
P&C Commercial	9 hr 1 min (541 min)	23.81%	44.44%	2,337	20,526,152	5.2%

Table 3: FS-PM Test Results

Below are more detailed results for two policy types, P&C Liability and P&C Commercial, showing server specific information that was collected for each different type of policy test. The maximum CPU percentage is based on one minute intervals. P&C Commercial was the longest running policy type – nine hours and one minute for 500,000 policies.

Host Name	Client Role	DI Proc.	Duration	Max CPU	Avg. CPU	Avg. IO / sec	Avg. OSA Port A bytes /sec	Avg. OSA Port B bytes /sec
S3A	dbserver	60	19:35 - 21:46	31.0%	22.0%	3,030	8,999,326	9,226,463
sapf70	DI	16	19:35 - 21:46	74.1%	62.1%			
sapf71	DI + 8 msg.PM threads	6	19:35 - 21:46	36.9%	30.4%			
sapf72	CI + DI	16	19:35 - 21:46	74.4%	61.1%			
sapf73	DI + 8 msg.PM threads	6	19:35 - 21:46	38.9%	34.9%			
sapf225	DI	16	19:35 - 21:46	74.9%	63.4%			

Table 4: Detail of FS-PM P&C Liability Test - 500,000 Policies

Host Name	Client Role	DI Proc.	Duration	Max CPU	Avg. CPU	Avg. IO / sec	Avg. OSA Port A bytes /sec	Avg. OSA Port B bytes /sec
S3A	DB Server	60	00:05 - 09:06	44.0%	23.81%	2,337	11,134,766	9,391,386
sapf70	DI	16	00:05 - 09:06	71.0%	56.5%			
sapf71	DI + 8 msg.PM threads	6	00:05 - 09:06	38.7%	27.1%			
sapf72	CI + DI	16	00:05 - 09:06	71.9%	56.3%			
sapf73	DI + 8 msg.PM threads	6	00:05 - 09:06	32.1%	25.6%			
sapf225	DI	16	00:05 - 09:06	70.9%	56.7%			

Table 5: Detail of FS-PM P&C Commercial Test - 500,000 Policies

As an example, plotted below are system utilization graphs for this test's DB Server and the peak busy application server.
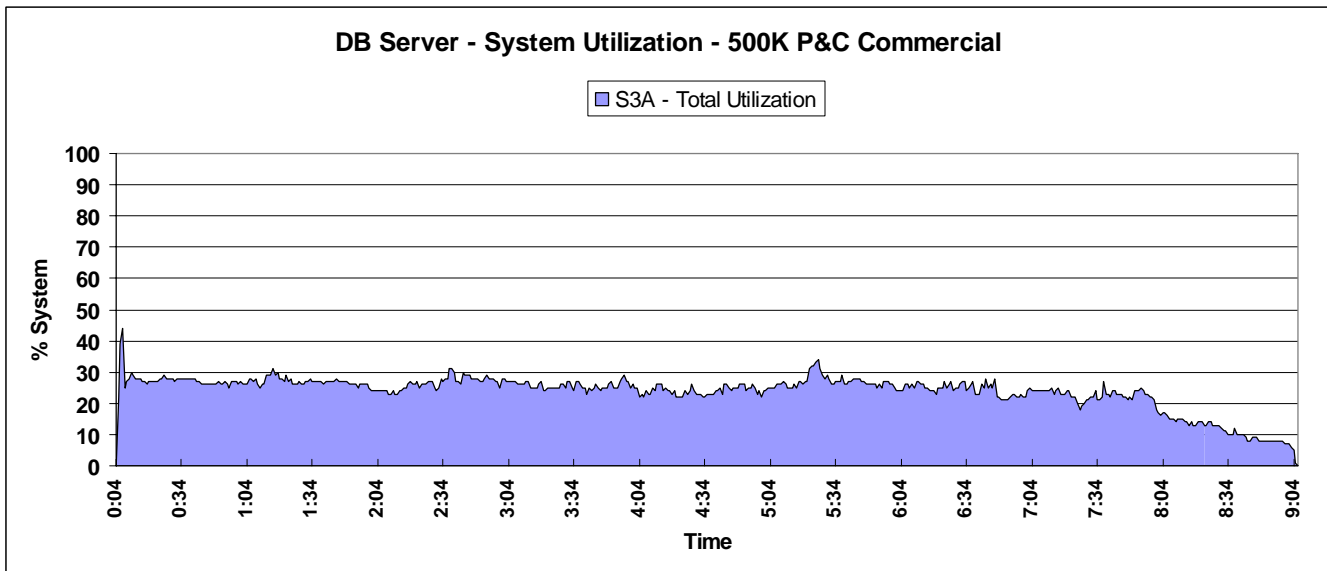

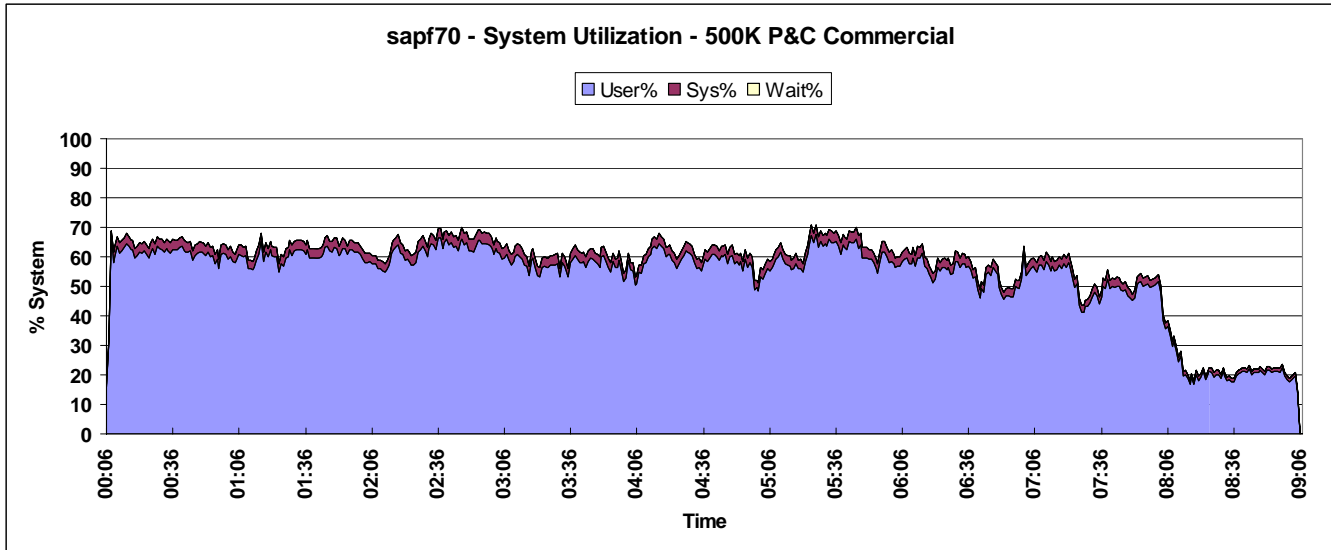**Figure 3: P&C Commercial – 500K Policies - DB Server Utilization**

Figure 4: P&C Commercial - 500K Policies - Apps Server sapf70 Utilization

When we began this project, we started tests with batches of 100,000 policies. As we gained experience with this application, many application changes were made and some tuning done. Below are P&C Liability and P&C Commercial 100,000 policy tests corresponding to the 500,000 tests shown above. We can compare the test to quantify the improvements made over the project. This is discussed in more detail in Section 9.1, "Large Objects and I/O Rates" on page 15.

Host Name	Client Role	DI Proc.	Duration	Max CPU	Avg. CPU%	Avg. IO / sec	Avg. OSA Port A bytes /sec	Avg. OSA Port B bytes /sec
S3A	DB Server	60	11:54 - 13:39	16.0%	10.9%	2,767	2,315,945	2,318,708
sapf70	DI	16	11:54 - 13:39	91.0%	84.6%			
sapf71	DI + 8 msg.PM threads	6	11:54 - 13:39	22.1%	16.3%			
sapf72	CI + DI	16	11:54 - 13:39	36.6%	28.4%			
sapf73	DI + 8 msg.PM threads	6	11:54 - 13:39	23.1%	16.3%			
sapf225	DI	16	11:54 - 13:39	43.2%	28.0%			

Table 6: Detail of FS-PM P&C Liability Test - 100,000 Policies

Host Name	Client Role	DI Proc.	Duration	Max CPU	Avg. CPU%	Avg. IO / sec	Avg. OSA Port A bytes /sec	Avg. OSA Port B bytes /sec
S3A	DB Server	60	16:44 - 20:18	32.0%	22.7%	4,726	8,566,124	7,350,955
sapf70	DI	16	16:44 - 20:18	63.2%	48.1%			
sapf71	DI + 8 msg.PM threads	6	16:44 - 20:18	52.3%	40.3%			
sapf72	CI + DI	16	16:44 - 20:18	56.5%	42.9%			
sapf73	DI + 8 msg.PM threads	6	16:44 - 20:18	53.4%	44.3%			
sapf225	DI	16	16:44 - 20:18	58.0%	46.5%			

Table 7: Detail of FS-PM P&C Commercial Test - 100,000 Policies

8.2 Financial Services – Collections and Disbursements (FS-CD) Results

Each test involved processing for 500,000 policies. As mentioned earlier, this application was already pretty well optimized by SAP. Additionally, it had relatively short durations. Below are listed the test results.

Business Function	Duration	Avg. CPU DB Server	Avg. CPU for 5 Apps Servers[1]	Avg. DB IO/sec	Avg. OSA bytes /sec
Payment Plan Transfer	7 min	5.10%	37.40%[2]	804	6,251,851
Payment Execution for Payment Run	13 min	25.70%	16.60%	2,200	15,850,800
Payment Run	13 min	30.20%	33.96%	1,918	23,920,229
Payment Execution for Payment Lot	10 min	32.50%	23.18%	2,985	20,175,737
Payment Lot	12 min	10.70%	24.04%	3,377	10,629,973

Table 8: FS-CD Test Results

8.3 Financial Services – Claims Management (FS-CM) Results

This test was not in the original test plan and was, pretty much, an after thought. However, we were able to run it on an ad-hoc basis. It consisted of 40 batch jobs, which were distributed (albeit not too evenly) across the five application servers.

Business Function	Duration	Claims	Avg. CPU DB Server	Avg. CPU for 5 Apps Servers	Avg. DB IO/sec	Avg. OSA bytes /sec
FS-CM	1 hr 3 min 24 sec (63 min 24 sec)	419,855	6.56%	57.02%	125	5,454,105

Table 9: FS-CM Test Results

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[1] Except for Payment Plan Transfer – which had one.
[2] Payment Plan Transfer had only one Apps Server.

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9 Analysis

Given that these tests focused on the interactions of the application with the infrastructure, and these tests were not performance tests or formal benchmarks, there were still some observations we made.

9.1 Large Objects and I/O Rates

From our perspective, one unique aspect of this SAP application's database design was the extensive use of Large Objects (LOBs). SAP for Insurance used binary LOBs instead of using many rows to store document text. The database had one LOB per policy. The average LOB had about one kilobyte, but consisted of many compressed line items.

Some SAP applications have an intrinsically high Database I/O intensity [6, 7]. Although SAP for Insurance showed significant variations in I/O intensity test to test, it did not show the same I/O intensity as these other workloads. However, like many workloads, HiperPAV [8] proved to be quite valuable in dynamically allocating and balancing access to the database. The workload's I/O consisted of both random and sequential (e.g., logging) operations. Further, the SQL statements seemed to be "light", like SD and SAP's Banking Day Posting workloads.

9.2 Comparing FS-PM 500K Tests to 100K Tests

As mentioned earlier, when we started on this project, we did some initial tests with 100,000 policies. As we gained experience with the application, there were many application changes made and some vestigial tuning done. We believe this allowed us to make significant improvements in application efficiency. As an example, we can compare the 500K to 100K results for two FS-PM policy measurements – P&C Liability and P&C commercial.

The details of these 500K tests are shown in Table 4 and Table 5 (starting on page 11). The corresponding 100K tests are shown in Table 6 and Table 7 (starting on page 13). We can quantify the differences using the _Large Systems Performance Report_'s [9] metrics like External Throughput Rate (ETR) and Internal Throughput Rate (ITR), and the associated ratios (ETRR, and ITRR). We also compared two other figures of merit – DB I/O's and OSA bytes per transaction. The results are shown in Figure 5 and Figure 6, below.
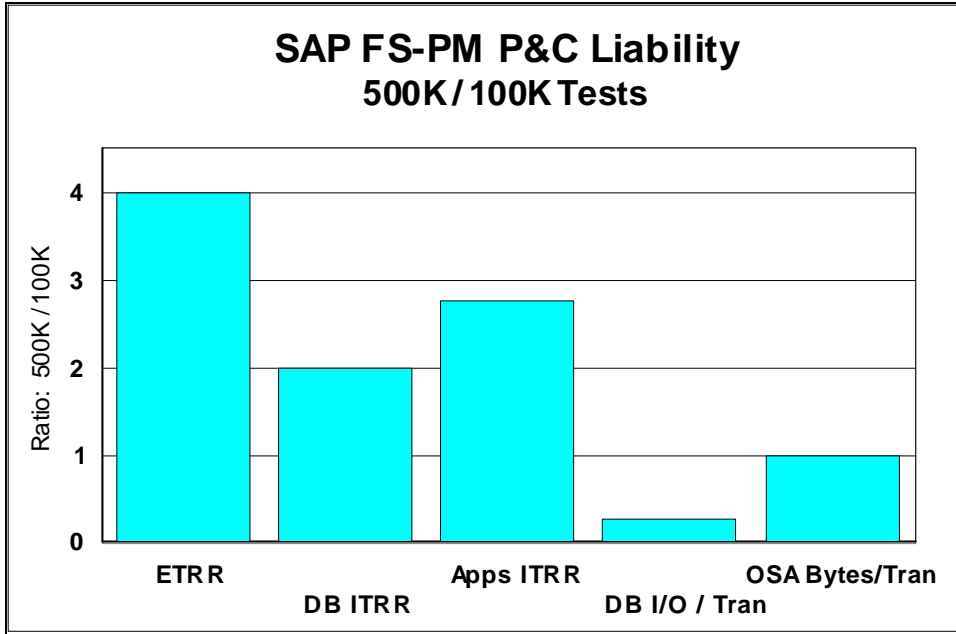
SAP FS-PM P&C Liability
500K / 100K Tests

Figure 5: Comparison of Older 100K vs. Newer 500K FS-PM P&C Liability Tests
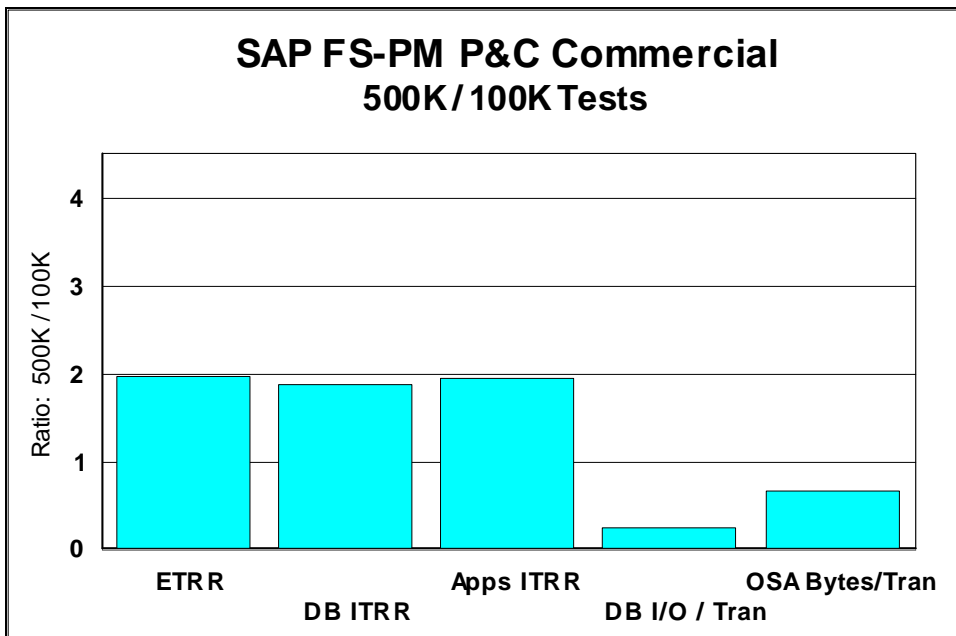
SAP FS-PM P&C Commercial
500K / 100K Tests

Figure 6: Comparison of Older 100K vs. Newer 500K FS-PM P&C Commercial Tests

For ETRR, DB ITRR, and Apps ITRR, higher is better for the 500K results. Conversely, for DB I/O and OSA bytes per transaction, lower is better for the 500K results. For example, our longest test was P&C Commercial. The 500K tests (Figure 6) showed about a two-fold improvement in transaction throughput (ETRR), DB CPU efficiency (DB ITRR), and Application Server CPU efficiency (Apps ITRR). As well, the DB I/O's per transaction were about 25% of the 100K tests and the OSA bytes per transaction were 66%. These are dramatic improvements in each metric. P&C Liability (Figure 5) also

showed different, but still very good, results for the newer test. We attribute these improvements to the changes SAP made to the application during the course of these measurements. We showed only two such comparisons. Other comparisons will likely show different numbers. Several of the changes made for the 500k tests are available to customers in FS-PM Release 5.0 SP3. Other resulting changes will be forthcoming.

10 Conclusions

As mentioned in Section 1, "Introduction" on page 4, these tests were not performance tests or formal benchmarks. Because of schedules, there was limited exposure of the application to the test environment. In addition, there were relatively low business volumes attempted. As a result, there was limited tuning or investigation of how to scale up the volumes.

All of that notwithstanding, we saw significant performance improvements made by SAP in the FS-PM application during the course of the tests. This illustrates that a well-written application can have a more profound influence on throughput and performance than optimizing a solid infrastructure.

There are several infrastructure product feature and function enhancements now available that could also significantly improve the performance of these tests. The first is the zEnterprise [10]. Its z196 shows significantly better SAP DB Server performance than the z9 used for these tests. As well, the z196 supports significantly faster I/O capabilities such as OSA-Express3 for network operations and FICON Express8 and the associated High Performance FICON for System z (zHPF) for file operations. Outside the zEnterprise, there are several newer and more powerful IBM System Storage DS8000 systems [11].

The recently delivered DB2 10 for z/OS [12] has several features and functions specifically implemented to improve SAP environments. One potentially important feature for SAP for Insurance is DB2 10's in-line LOBs. Certainly, the DB2 10 virtual storage constraint relief will help all large SAP on z systems – including large SAP for Insurance systems.

11 References

[1] SAP AG 2009. *SAP for Insurance on IBM System z Reference Architecture*
http://www.sdn.sap.com/irj/sdn/db2?rid=/library/uuid/806914a9-16df-2b10-96a0-eec0b1296f10
[2] SAP AG 2011. *SAP for Insurance* http://www.sap.com/industries/insurance/index.epx
[3] SAP AG 2011. *SAP Policy Management*
http://www.sap.com/industries/insurance/policymanagement.epx
[4] IBM Corp. 2008. US Announcement Letter 108-869: *IBM System Storage DS8000 series (Machine type 2107) delivers new functional capabilities (zHPF and RMZ resync) for System z environments*
http://www.ibm.com/common/ssi/cgi-bin/ssialias?infotype=AN&subtype=CA&htmlfid=897/ENUS108-869&appname=USN
[5] IBM Corp. 2009. *IBM System z10 I/O and High Performance FICON for System z Channel Performance* ftp://ftp.software.ibm.com/common/ssi/sa/wh/n/zsw03058usen/ZSW03058USEN.PDF
[6] IBM Corp. 2009. IBM System z® *and System Storage DS8000: Accelerating the SAP® Deposits Management Workload With Solid State Disks*
http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101442 or msheets@us.ibm.com

[7] IBM Corp. 2010. IBM System z®: *SAP*® *Bank Analyzer 7.0 Tests*
http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101812 or msheets@us.ibm.com
[8] IBM Corp. 2006. US Announcement Letter 106-811. *IBM System Storage DS8000 series (machine type 2107) delivers HyperPAV* http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=ca&infotype=an&appname=iSource&supplier=897&letternum=ENUS106-811
[9] IBM Corp. 2010. *Large Systems Performance Reference*
https://www.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprindexpdf/$file/SC28118714_20100714.pdf
[10] IBM Corp. 2010. *IBM zEnterprise System* http://www.ibm.com/systems/z/hardware/zenterprise/
[11] IBM Corp. 2010. *New IBM System Storage DS8800*
http://www.ibm.com/systems/storage/news/center/disk/enterprise/
[12] IBM Corp. 2010. *DB2 10 for z/OS* http://www.ibm.com/software/data/db2/zos/