



**SPC BENCHMARK 1™
EXECUTIVE SUMMARY**

**IBM CORPORATION
IBM POWER™ 595 WITH POWERVM™ (SSDs)**

SPC-1 V1.11

**Submitted for Review: October 7, 2009
Submission Identifier: A00083**

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	IBM Corporation – http://www.ibm.com Bruce McNutt – bmcnutt@us.ibm.com 650 Harry Road San Jose, CA 95120 Phone: (408) 927-2717
Test Sponsor Alternate Contact	IBM Corporation – http://www.ibm.com David Whitworth – davidw@us.ibm.com 11501 Burnet Rd. Austin, TX 78758 Phone: (512) 286-9218
Auditor	Storage Performance Council – http://www.storageperformance.org Walter E. Baker – AuditService@StoragePerformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

Revision Information and Key Dates	
SPC-1 Specification revision number	V1.11
SPC-1 Workload Generator revision number	V2.1.0
Date Results were first used publicly	October 7, 2009
Date the FDR was submitted to the SPC	October 7, 2009
Date the priced storage configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	October 5, 2009

Tested Storage Product (TSP) Description

This submission features the IBM Power 595 host processor as a virtualization platform, which is included in the Priced Storage Configuration. The Power 595, as configured for this submission, includes the IBM PowerVM Enterprise Edition with Power Hypervisor, which allows multiple AIX Logical Partitions (*LPARs*) to run with high levels of I/O and processor performance. Each LPAR functions as an independent logical host system. I/O virtualization is provided with the Virtual I/O Server (VIOS), a feature of IBM PowerVM.

The Power 595 processing platform capability for I/O virtualization, with high levels of I/O performance, has the ability to support a wide variety of storage technologies. The present submission showcases the performance potential of this platform with the use of the EXP12S enclosure as a base for housing a total of 84 solid state drives.

Summary of Results

SPC-1 Results	
Tested Storage Configuration (TSC) Name: IBM Power™ 595 with PowerVM™ (SSDs)	
Metric	Reported Result
SPC-1 IOPS™	300,993.85
SPC-1 Price-Performance	\$10.77/SPC-1 IOPS™
Total ASU Capacity	2,874.944 GB
Data Protection Level	Protected (<i>Mirroring</i>)
Total TSC Price (including three-year maintenance)	\$3,243,117

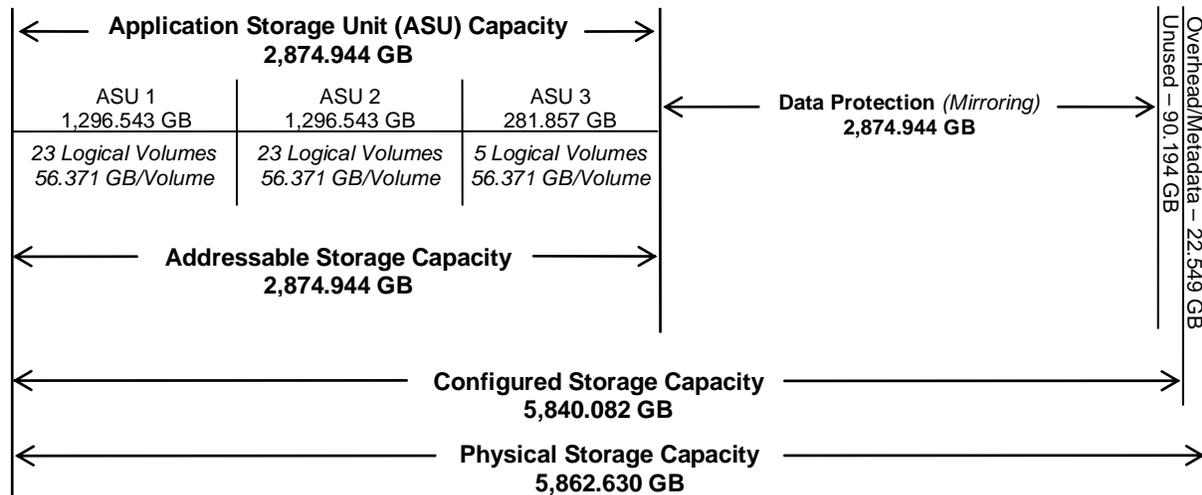
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) Capacity represents the total storage capacity read and written in the course of executing the SPC-1 benchmark.

A Data Protection Level of Protected using *Mirroring* configures two or more identical copies of user data. The data protection consisted of a logical volume group with two copy pools, managed by the AIX Logical Volume Manager (LVM).

Storage Capacities and Relationships

The following diagram and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.



SPC-1 Storage Capacity Utilization	
Application Utilization	49.04%
Protected Application Utilization	98.08%
Unused Storage Ratio	1.54%

Application Utilization: Total ASU Capacity (2,874.944 GB) divided by Physical Storage Capacity (5,862.630 GB)

Protected Application Utilization: (Total ASU Capacity (2,874.944 GB) plus total Data Protection Capacity (2,874.944 GB) minus unused Data Protection Capacity (0.000 GB)) divided by Physical Storage Capacity (5,862.630 GB)

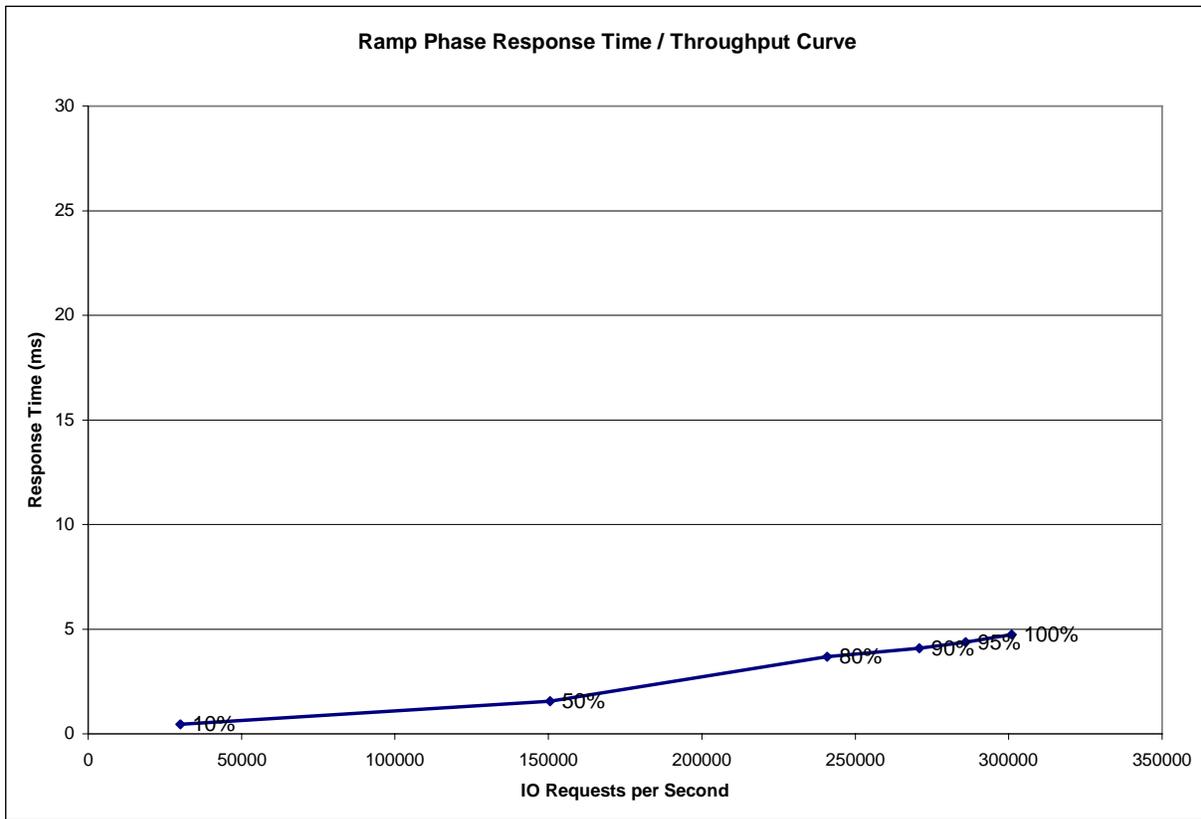
Unused Storage Ratio: Total Unused Capacity (90.194 GB) divided by Physical Storage Capacity (5,862.630 GB) and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 19-20 in the Full Disclosure Report.

Response Time - Throughput Curve

The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at the any of the above load points cannot exceed 30 milliseconds or the benchmark measurement is invalid.



Response Time - Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	30,097.66	150,494.88	240,804.68	270,883.02	285,989.55	300,993.85
Average Response Time (ms):						
All ASUs	0.46	1.55	3.68	4.08	4.37	4.75
ASU-1	0.53	1.82	4.05	4.53	4.85	5.25
ASU-2	0.54	1.85	4.06	4.51	4.81	5.17
ASU-3	0.26	0.85	2.71	2.94	3.17	3.51
Reads	0.80	2.67	5.20	5.87	6.27	6.73
Writes	0.23	0.82	2.69	2.92	3.14	3.47

Tested Storage Configuration Pricing (Priced Storage Configuration)

Product Description	Qty	Unit Price	Ext Price	Unit Maint per month	Unit Maint OTC	Maint Price
Server						
9119-595 Power 595 host processor	1	91,000	91,000	2625		63,000
0553 19 inch, 2.0 meter high rack	1	4,745	4,745			
1816 GX Bus I/O Hub, 2-Port, IBT-copper, (Ranger-C) (InfiniBand)	4	4,000	16,000			
1831 2.5M Enhanced 12X Cable (to connect to a gx card in node)	8	650	5,200			
1834 8.0 Meter 12X Cable	4	960	3,840			
3279 146.8 GB 15K RPM Ultra320 Disk Drive	16	1,299	20,784			
4705 0/8 - core, 64GB-enabled POWER6 5.0GHz CoD, 0-core Active	6	67,700	406,200	520		74,880
4755 Single Processor Activation for FC 4695 (5.0 GHz)	48	30,300	1,454,400	280		322,560
5681 256GB Bundle DDR2 Activations	1	387,840	387,840			
5701 IBM 2-Port 10/100/1000 Base-TX Ethernet PCI-X Adapter	5	699	3,495			
5720 DVD/Tape SAS External Storage Unit	1	3,599	3,599			
5756 IDE Slimline DVD-ROM Drive	1	275	275			
5797 12x I/O Drawer PCI-X, with repeater	2	32,000	64,000	170		8,160
5912 PCI-X DDR Dual - x4 SAS Adapter	1	1,092	1,092			
5951 Quiet Touch Keyboard - USB, Business Black,	1	104	104			
6333 Bulk Power Regulator	6	4,200	25,200			
6334 Bulk Power Distribution Assembly	2	2,500	5,000			
6654 14-Ft 1PH/24-30A Pwr Cord	3	240	720			
6865 Acoustic Doors (F&F), H CEC Rack	1	12,000	12,000			
6869 Acoustic Doors (F&F), H I/O Expansion Rack	1	14,500	14,500			
6941 UPIC Cable Group, BPD1 to I/O Drawer at A01	2	500	1,000			
6942 UPIC Cable Group, BPD1 to I/O Drawer at A05	1	500	500			
6943 UPIC Cable Group, BPD1 to I/O Drawer at A09	1	500	500			
6952 UPIC Y-Cable Group (BPC to Fans)	1	5,000	5,000			
6961 UPIC Y-Cable Group BPD1 to Processor Nodes	4	650	2,600			
7188 Power Distribution Unit	3	3,000	9,000			
7802 Ethernet Cable, 15M, Hardware Management	2	34	68			
8201 0/256GB 667MHz DDR2 Memory Package (32x#5694)	1	97,120	97,120			
8696 Line Cord, 6AWG/Type W, 14ft, IEC309 60A Plug	4	2,500	10,000			
8841 Mouse - Business Black with Keyboard Attachment	1	78	78			
7042-C06 HMC 1:7042-C06 Desktop Hardw.Mgmt.Console	1	1,830	1,830	48	192	1,344
5692-A6P AIX V6 (media only)	1	50	50			
5765-G62 AIX Software per Processor	48	2,495	119,760			
5765-AME AIX IBM Management Edition for AIX	48	490	23,520			
5764-PVE PowerVM Enterprise Edition	48	1,999	95,952			
5773-SM3-474 AIX Software Maintenance (3Y)	48	2,836	136,128			
5773-SM3-476 AIX Software Maintenance 24x7 Upgrade (3Y)	48	732	35,136			
5773-PVE-1007 PowerVM Enterprise Edition SW Maintenance (3Y)	48	594	28,512			
5773-AME-989 AIX IBM Mgmt Edition of AIX Software Maintenance (3Y)	48	196	9,408			
5773-0570 HMC Software SUB (3Y)	1	236	236			
5773-0569 HMC Software Support (3Y)	1	675	675			
			3,097,067			469,944
Storage						
3586 69GB 3.5 SAS Solid State Drive	84	13,235	1,111,740			
3692 SAS Cable (YO) Adapter to SAS Enclosure	14	146	2,044			
5886 EXP12S Expansion Drawer	14	5,956	83,384	200		67,200
5904 PCI-X DDR 1.5GB cache SAS RAID Adapter (BSC)	14	11,250	157,500			
6671 Power Cord (9-foot), Drawer to IBM PDU, 250V/10A	28	19	532			
			1,355,200			67,200
			Subtotal			537,144
Discount (Server 35%)			(1,083,973)			(164,480)
Discount (Storage 35%)			(474,320)			(23,520)
			2,893,974			349,144
			Total			3,243,117

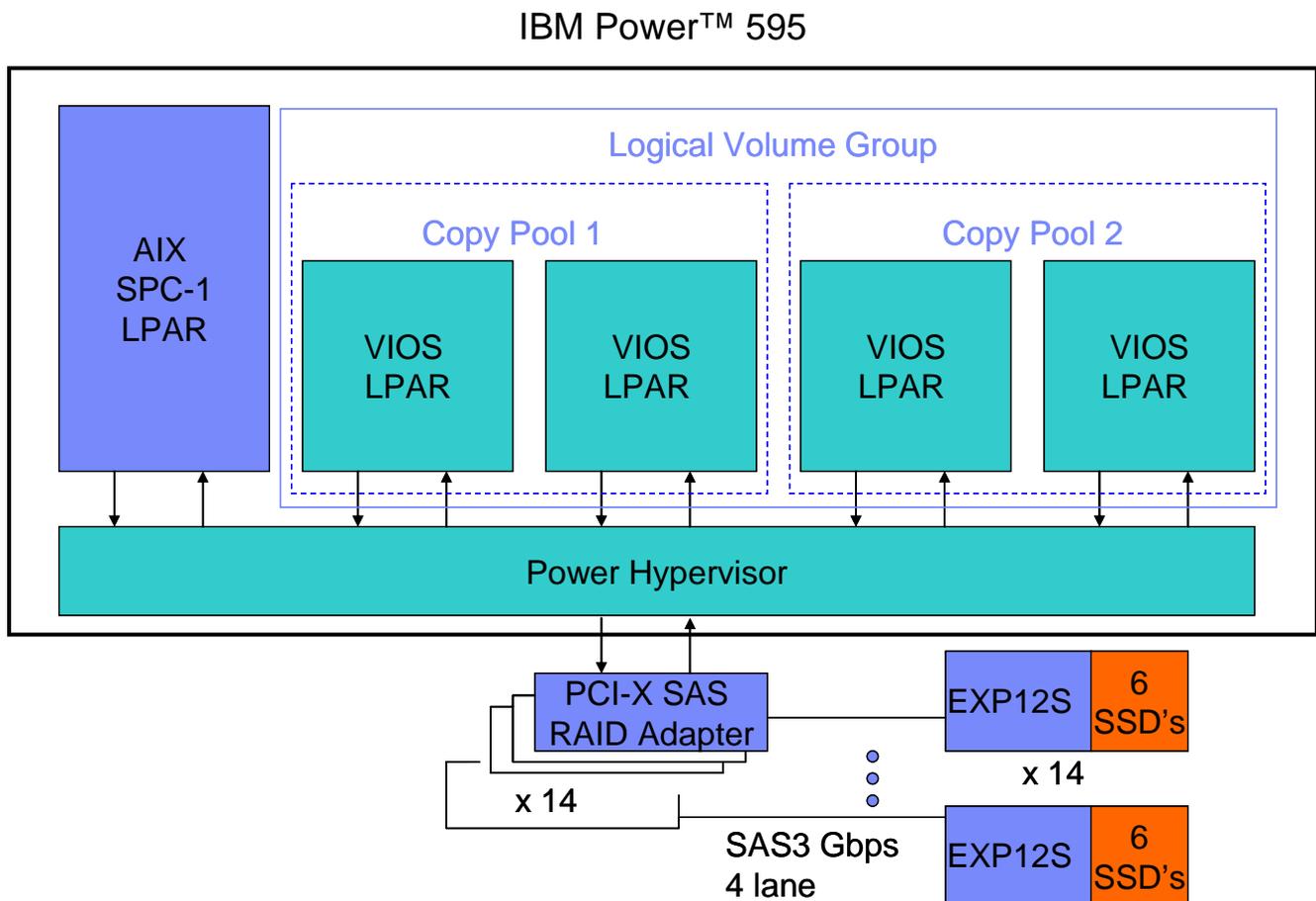
Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

The IBM Power™ 595 in the TSC contained 64 Power6 cores on 32 chips. The TSC only utilized 48 of the cores on 24 chips as illustrated below and listed on page 8. The remaining 16 cores on 8 chips were unused during the benchmark measurements and not included in the Priced Storage Configuration.

Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Priced Storage Configuration Diagram

The IBM Power™ 595 in the BC/ TSC contained 64 Power6 cores on 32 chips. The TSC only utilized 48 of the cores on 24 chips. The remaining 16 cores on 8 chips were unused during the benchmark measurements and not included in the Priced Storage Configuration.

Both the BC/TSC and the Priced Storage Configuration included 16 Ultra320 system disk drives that were not part of the SPC-1 data repository.



Benchmark Configuration/Tested Storage Configuration Priced Storage Configuration Components

Tested Storage Configuration (TSC) / Priced Storage Configuration:
IBM Power™ 595: 48 – 5.0 GHz Power6 cores on 24 chips (2 cores per chip) 4 MB L2 cache per core 32 MB L3 cache per chip LPAR 1 – Host System (WG): 32 cores LPAR 2 – Virtual I/O Server 1: 4 cores LPAR 3 – Virtual I/O Server 2: 4 cores LPAR 4 – Virtual I/O Server 3: 6 cores LPAR 5 – Virtual I/O Server 4: 2 cores <i>(The BC/TSC contained 16 additional Power6 cores that were unused in the benchmark measurements and not included in the Priced Storage Configuration)</i>
256 GB main memory: LPAR 1 – Host System (WG): 200 GB LPAR 2 – Virtual I/O Server 1: 8 GB LPAR 3 – Virtual I/O Server 2: 8 GB LPAR 4 – Virtual I/O Server 3: 8 GB LPAR 5 – Virtual I/O Server 4: 8 GB
14 – PCI-X DDR 1.5 GB cache SAS RAID Adapters
14 – EXP12S expansion drawers
84 – 69.793 GB 3.5" SAS Solid State Devices (SSDs) 6 SSDs per EXP12S
AIX 6.1
IBM PowerVM, Enterprise Edition including Virtual I/O Server (VIOS)
AIX Logical Volume Manager (LVM)
PCI-X