

## Performance of an Active Compellent SAN

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### *Abstract*

Having a black out window to afforded us the ability to compare performance of a heavily utilized versus an idle Compellent storage system. Four tests were performed: a baseline Windows 2003 system with a dedicated disk drive; a test performed at relatively high load (during nightly backups and processes); a test with a single server and thus dedicated IO; and finally a test with all servers online but relatively idle.

These performance test results suggest that the Compellent is successfully scaling up when IO demands it.

## *Storage Configuration*

Compellent Controllers.....Westville C10 Dual Controllers  
Enclosures .....9  
Disks .....124 10K 300 GB

Attached Servers..... 123  
Volumes ..... 326  
Volume Raid Level..... RAID10

# IOmeter Configuration File

Version 2006.07.27

'TEST SETUP

=====  
'Test Description  
    Compellent 2007-0723 64K IO Testing

'Run Time  
'    hours        minutes    seconds  
    0            5            0

'Ramp Up Time (s)  
    0

'Default Disk Workers to Spawn  
    NUMBER\_OF\_CPUS

'Default Network Workers to Spawn  
    0

'Record Results  
    ALL

'Worker Cycling  
'    start    step        step type  
    1          1            LINEAR

'Disk Cycling  
'    start    step        step type  
    1          1            LINEAR

'Queue Depth Cycling  
'    start    end        step        step type  
    1          32          2            EXPONENTIAL

'Test Type  
    CYCLE\_TARGETS

'END test setup

'RESULTS DISPLAY

=====  
'Update Frequency, Update Type  
    5, WHOLE\_TEST

'Bar chart 1 statistic  
    Total I/Os per Second

'Bar chart 2 statistic  
    Total MBs per Second

'Bar chart 3 statistic  
    Average I/O Response Time (ms)

'Bar chart 4 statistic  
    Maximum I/O Response Time (ms)

'Bar chart 5 statistic  
    % CPU Utilization (total)

'Bar chart 6 statistic  
    Total Error Count

'END results display

'ACCESS SPECIFICATIONS

=====  
'Access specification name, default assignment  
    512 Byte Data Streaming Read, DISK

'size, % of size, % reads, % random, delay, burst, align, reply  
    512, 100, 100, 0, 0, 1, 0, 0

'Access specification name, default assignment  
    512 Byte Data Streaming Write, DISK

'size, % of size, % reads, % random, delay, burst, align, reply  
    512, 100, 0, 0, 0, 1, 0, 0

```

'Access specification name,default assignment
    64K Data Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    65536,100,100,0,0,1,0,0
'Access specification name,default assignment
    64K Data Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    65536,100,0,0,0,1,0,0
'Access specification name,default assignment
    File Server,DISK
'size,% of size,% reads,% random,delay,burst,align,reply
    512,10,80,100,0,1,0,0
    1024,5,80,100,0,1,0,0
    2048,5,80,100,0,1,0,0
    4096,60,80,100,0,1,0,0
    8192,2,80,100,0,1,0,0
    16384,4,80,100,0,1,0,0
    32768,4,80,100,0,1,0,0
    65536,10,80,100,0,1,0,0
'Access specification name,default assignment
    Web Server,DISK
'size,% of size,% reads,% random,delay,burst,align,reply
    512,22,100,100,0,1,0,0
    1024,15,100,100,0,1,0,0
    2048,8,100,100,0,1,0,0
    4096,23,100,100,0,1,0,0
    8192,15,100,100,0,1,0,0
    16384,2,100,100,0,1,0,0
    32768,6,100,100,0,1,0,0
    65536,7,100,100,0,1,0,0
    131072,1,100,100,0,1,0,0
    524288,1,100,100,0,1,0,0
'Access specification name,default assignment
    128K Data Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    131072,100,0,0,0,1,0,0
'Access specification name,default assignment
    128K Data Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    131072,100,100,0,0,1,0,0
'Access specification name,default assignment
    64K Data Random Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    65536,100,0,100,0,1,0,0
'Access specification name,default assignment
    64K Data Random Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    65536,100,100,100,0,1,0,0
'Access specification name,default assignment
    64K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    65536,100,50,100,0,1,0,0
'Access specification name,default assignment
    128K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    131072,100,50,100,0,1,0,0
'Access specification name,default assignment
    2K Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    2048,100,100,0,0,1,0,0

```

```

'Access specification name,default assignment
    2K Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    2048,100,0,0,0,1,0,0
'Access specification name,default assignment
    2K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    2048,100,50,100,0,1,0,0
'Access specification name,default assignment
    4K Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    4096,100,100,0,0,1,0,0
'Access specification name,default assignment
    4K Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    4096,100,0,0,0,1,0,0
'Access specification name,default assignment
    4K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    4096,100,50,100,0,1,0,0
'Access specification name,default assignment
    8K Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    8192,100,100,0,0,1,0,0
'Access specification name,default assignment
    8K Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    8192,100,0,0,0,1,0,0
'Access specification name,default assignment
    8K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    8192,100,50,100,0,1,0,0
'Access specification name,default assignment
    32K Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    32768,100,0,0,0,1,0,0
'Access specification name,default assignment
    32K Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    32768,100,100,0,0,1,0,0
'Access specification name,default assignment
    32K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    32768,100,50,100,0,1,0,0
'Access specification name,default assignment
    256K Data Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    262144,100,99,0,0,1,0,0
'Access specification name,default assignment
    256K Data Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    262144,100,0,0,0,1,0,0
'Access specification name,default assignment
    256K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    262144,100,50,100,0,1,0,0
'Access specification name,default assignment
    512K Data Streaming Read,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    524288,100,100,0,0,1,0,0

```

```

'Access specification name,default assignment
    512K Data Streaming Write,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    524288,100,0,0,0,1,0,0
'Access specification name,default assignment
    512K Data Random Split,ALL
'size,% of size,% reads,% random,delay,burst,align,reply
    524288,100,50,100,0,1,0,0
'END access specifications
'MANAGER
=====
'Manager ID, manager name
    1,DB5
'Manager network address
    192.168.1.83
'Worker
    Worker 1
'Worker type
    DISK
'Default target settings for worker
'Number of outstanding IOs,test connection rate,transactions per
connection
    10,DISABLED,1
'Disk maximum size,starting sector
    0,0
'End default target settings for worker
'Assigned access specs
    64K Data Streaming Read
    64K Data Streaming Write
    64K Data Random Read
    64K Data Random Write
'End assigned access specs
'Target assignments
'Target
    D:Db5 swap
'Target type
    DISK
'End target
'End target assignments
'End worker
'End manager
'END manager list
Version 2006.07.27
LIST

```

## Performance Test Results

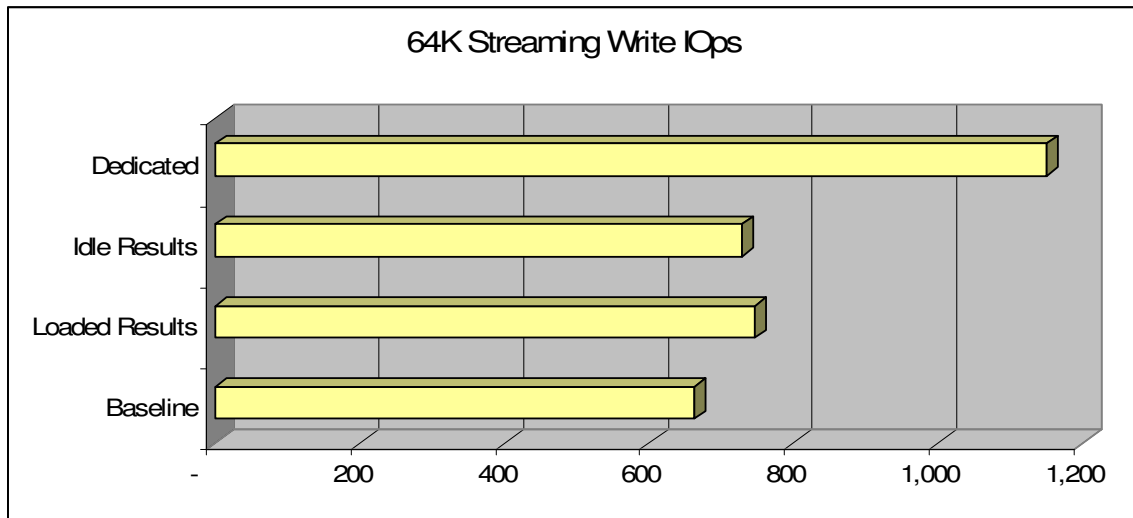
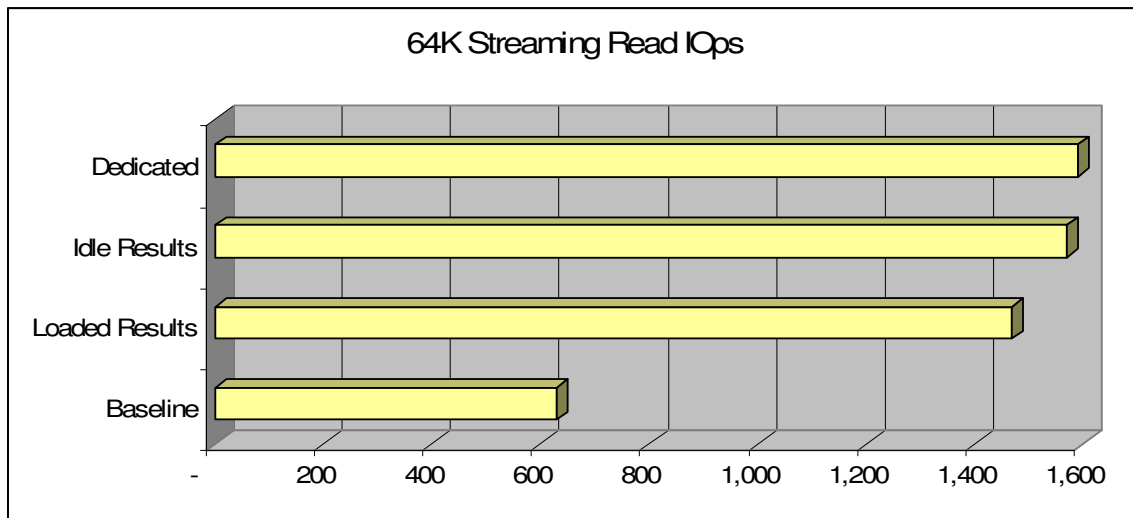
The following charts compare results from four tests:

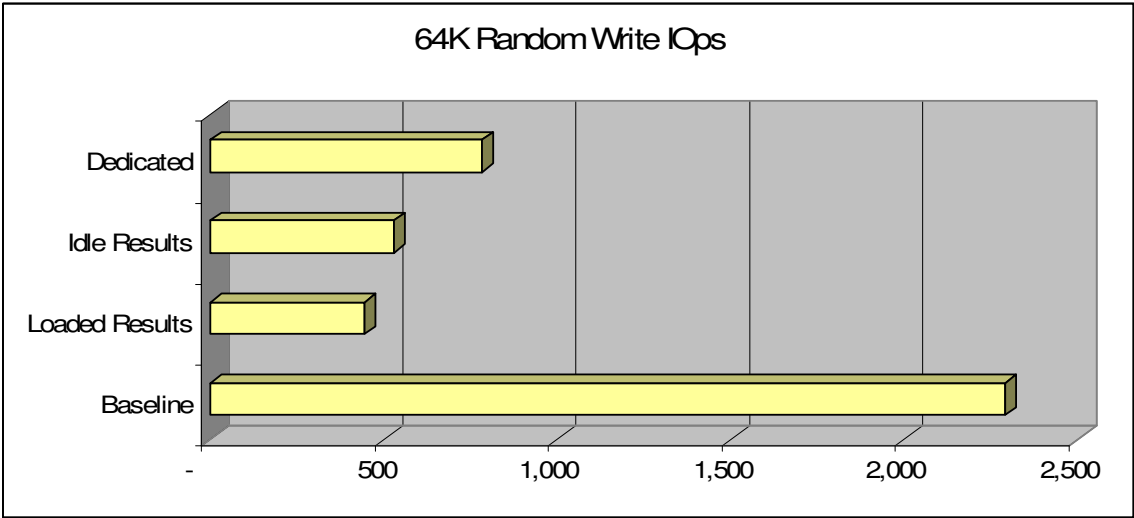
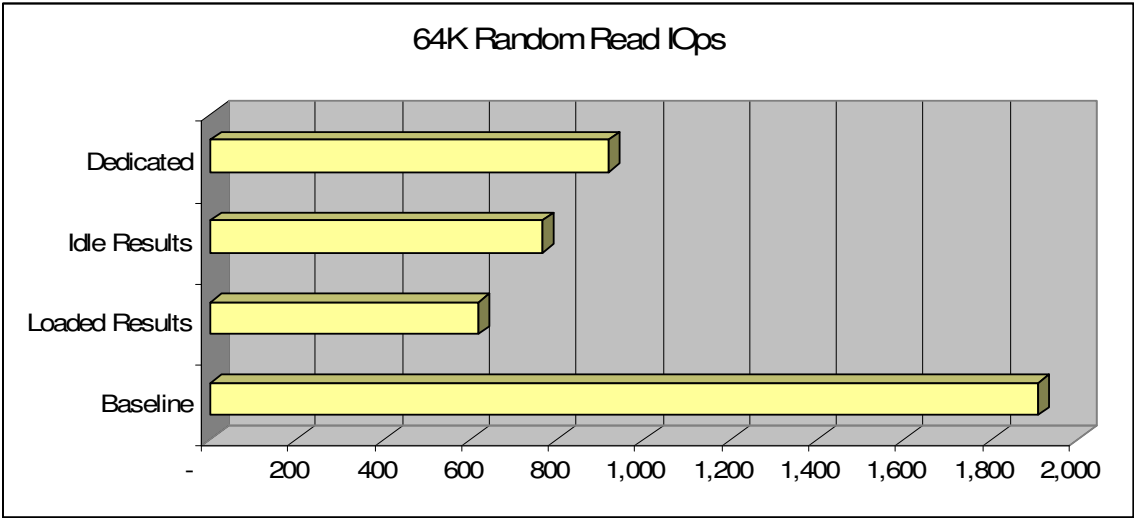
**Dedicated.** The entire Compellent SAN dedicated to servicing IO requests from one Windows Server 2003 system.

**Idle.** All servers online and yet relatively idle; servicing no client requests.

**Loaded.** All servers online and under load; running nightly processes and backup jobs.

**Baseline.** A Windows Server 2003 system with a single dedicated hard disk drive.







## *Performance Test Data*

<b>Baseline</b>	<b>IOps</b>	<b>MBps</b>
64K Data Streaming Read	629.477	39.342
64K Data Streaming Write	663.641	41.478
64K Data Random Read	1,908.312	119.269
64K Data Random Write	2,292.234	143.265

<b>Loaded Results</b>	<b>IOps</b>	<b>MBps</b>
64K Data Streaming Read	1,468.927	91.808
64K Data Streaming Write	748.285	46.768
64K Data Random Read	620.432	38.777
64K Data Random Write	447.361	27.960

<b>Dedicated</b>	<b>IOps</b>	<b>MBps</b>
64K Data Streaming Read	1,590.806	99.425
64K Data Streaming Write	1,151.118	71.945
64K Data Random Read	920.434	57.527
64K Data Random Write	783.249	48.953

<b>Idle Results</b>	<b>IOps</b>	<b>MBps</b>
64K Data Streaming Read	1,572.388	98.274
64K Data Streaming Write	730.068	45.629
64K Data Random Read	769.015	48.063
64K Data Random Write	529.022	33.064

## *Summary*

As expected, the SAN outperforms direct-attached storage for streaming IO. With a dedicated spindle, direct-attached outperforms SAN on random IO.

The difference between dedicated and loaded IO performance was much less than expected. Streaming read improved by only 8%, random read by 48%. The difference in write was higher: streaming was 54% and random 75%.

Consider that the front-end IOps decreased by an order of magnitude between dedicated and loaded, from approximately 15,000 IOps to 1,500. The delta in performance between dedicated and loaded suggests that the Compellent is successfully scaling up when IO demands it.