B-Test T10KC Drive with SAM-FS/QFS

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in der Helmholtz-Gemeinschaft

Overview

- Tape drive
- Test hardware
- Installation
- Performance Test
- (Write/Read (SSD) SAM-FS/QFS
- Write/Read (6 internal SAS Disks Raid 0
- Write direct on tape
- Capacity
- Conclusion

Tape drive

Specifications:

Native capacity:	(uncompressed) 5TB
Data transfer rate, native:	(uncompressed) 240 MB/sec
Data transfer rate, maximum:	(compressed) 360 MB/sec
Access time:	Tape load and thread: 13.1 sec
Average file access:	(excludes load/thread): 57 sec
Maximum rewind:	115 sec
Unload time:	26 sec
Buffer:	2 GB
Interface:	4 Gb native Fibre Channel, native FICON
Read compatibility:	T10000A and T10000B on StorageTek T10000 media
Emulation modes 3592:	(MVS), VSM
Automation:	StorageTek SL8500, StorageTek SL3000,

Tape **drive**

Picture

Fotos: Oracle-StorageTek

Test hardware

	Sun M3000 (bnbackup)	Sun X4140 (calypso3)
System Configuration:	Sun Microsystems sun4u Sun SPARC Enterprise M3000 Server (SPARC64-VII)	Sun Microsystems Sun Fire X4140 (i86pc)
CPU:	Origin = 1 NumCPU = 8	Origin = 2 NumCPU = 8
System clock frequency:	1064 MHz	2300 MHz
Memory size:	16384 Megabytes	32768 Megabytes
Storage (Disk):	Storage Tek FLX 680 Shared RAID 5 2 internal Disks for OS (Mirror)	6 internal SAS 146GB Disks + SAS Raidcontroller 8xPCIe RAID 0 1 internal Disk for OS 1 internal Disk for Metadata
SSD:		XTA-FAS-S3IE96GB-N, Sun Flash Accelerator F20 PCIe Card, 96GB native splitted to 4 drives á 21GB striped in one SAM-FS with 91GB effective
Connection Disk-SAN:	2 x 4Gb FC-AL	-
Connection Tape-SAN:	2 x 4Gb FC-AL	2 x 4Gb FC-AL

Installation

M3000

- Solaris update U9

  SunOS bnbackup 5.10 Generic_144488-04 sun4u sparc SUNW,SPARC-Enterprise

- SAM-FS installation patch 126508-7 Release 5.2.2

  mcf:

  ```
  test   1      ma     test
  /dev/dsk/c3t500104F0008BA9F2d4s3 101 mm test - /dev/rdsk/c3t500104F0008BA9F2d4s3
  /dev/dsk/c3t500104F0008BA9F2d3s6 102 mr test - /dev/rdsk/c3t500104F0008BA9F2d3s6

  /etc/opt/SUNWsamfs/stk80      80     sk     stk80   -     /var/opt/SUNWsamfs/catalog/stk80_cat
  # Drives
  /dev/rmt/2cbn   81     tp     stk80   on     #T10kC
  #/dev/rmt/3bn   82     tp     stk80   on     #T10kC
  ```

- file system on Raid5 FLX-680
- Metadata on different group

Installation

M3000

- Konfiguration für SL8500

  stk80:

  hostname = 192.168.238.11
  portnum = 50016
  ssihost = 192.168.238.12

  # STK Drive SL8500
  /dev/rmt/2cbn = (acs=0, lsm=1, panel=1, drive=1) #B44 576001000541
  #/dev/rmt/3bn = (acs=0, lsm=0, panel=1, drive=3) #B52 576001000564

- Entry ssihost was important – different subnets
- Definition of drive in last row of file stk80 – the drive was not be initialized
- Blank row or comment as last row brings success

Installation

X4140

- Performance tests with standard raid-controller using mkfile, dd
  - 8 hard disks with striping (raid0)
  - 6 hard disks with Stripe (raid0), 1HD OS, 1HD reserve (metadata)
  - all hard disks as single raid0 defined
- Installation Solaris 10 U9 for X86

  SunOS calypso3 5.10 Generic_139556-08 i86pc i386 i86pc
- SAM-FS patch 146544-01 release 5.2.2
- Installation F20 Accelerator card 4*24GB native
- Only using of internal hard disks no connection to Disk-San

Installation

X4140

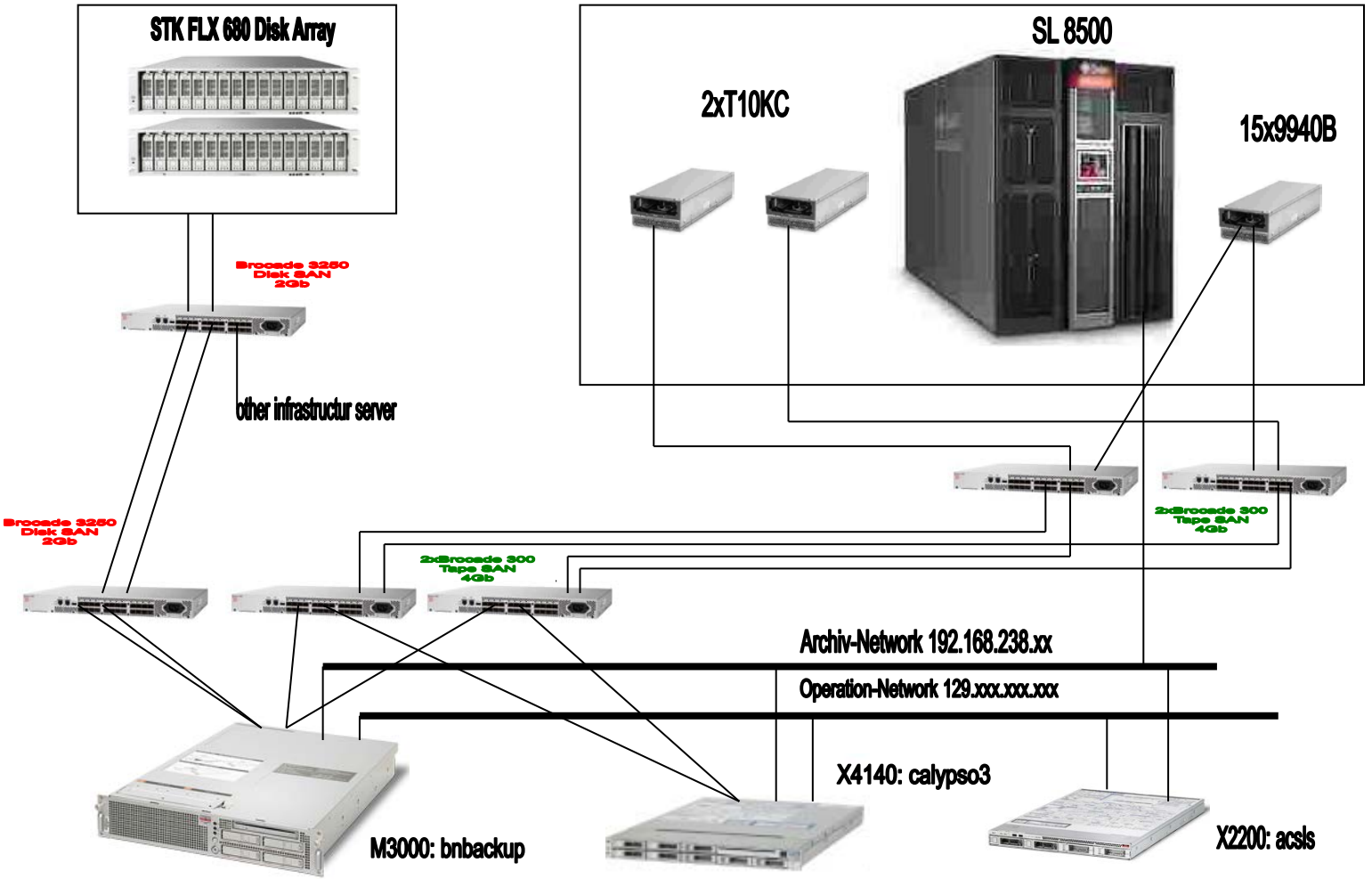
- Variante 1: Metadata on extra HD, 1st FS on RAID, 2nd FS F20 (ramdisk)
- Variante 2: Metadata on F20 as ramdisk

mcf:

```
test    1       ma      test
/dev/dsk/c1t1d0s2 101 mm test - /dev/rdsk/c1t1d0s2
#/dev/ramdisk/ramdi 100 mm test -
/dev/dsk/c1t2d0s2 102 mr test - /dev/rdsk/c1t2d0s2
/dev/dsk/c1t3d0s2 103 mr test - /dev/rdsk/c1t3d0s2
/dev/dsk/c1t4d0s2 104 mr test - /dev/rdsk/c1t4d0s2
/dev/dsk/c1t5d0s2 105 mr test - /dev/rdsk/c1t5d0s2
/dev/dsk/c1t6d0s2 106 mr test - /dev/rdsk/c1t6d0s2
/dev/dsk/c1t7d0s2 107 mr test - /dev/rdsk/c1t7d0s2

ramdi 2 ms ramdi
/dev/ramdisk/ramdisk 201 md ramdi -

#flash 3 ms flash
#/dev/dsk/c4t0d0s0      300     md      flash   -
#/dev/dsk/c4t1d0s0      301     md      flash   -
#/dev/dsk/c4t2d0s0      302     md      flash   -
#/dev/dsk/c4t3d0s0      303     md      flash   -

# Drives
/etc/opt/SUNWsamfs/stk80      80      sk      stk80   -       /var/opt/SUNWsamfs/catalog/stk80_cat
#/dev/rmt/0cbn   82      tp      stk80   on      #T10kC
/dev/rmt/0bn    83      tp      stk80   on      #T10kC
```

Installation

Configuration



Installation

ACSLS and SL8500

- 2 STK T10000C delivered in Tray
- ACSLS Version Update
- 8 cassettes and one clean cassett was delivered
- Cassette-labels was delivered
- connecting tape drives to FC-switch and creating of zones
- It was possible to import labeled cassettes via CAP in to the SL8500

- Testing !!
- Wile last testing cycles one drive open a clean request.
- This request couldn’t be show in SAM-FS only in OS

Performance Test

Test files

Mix of typical remote sensing data.

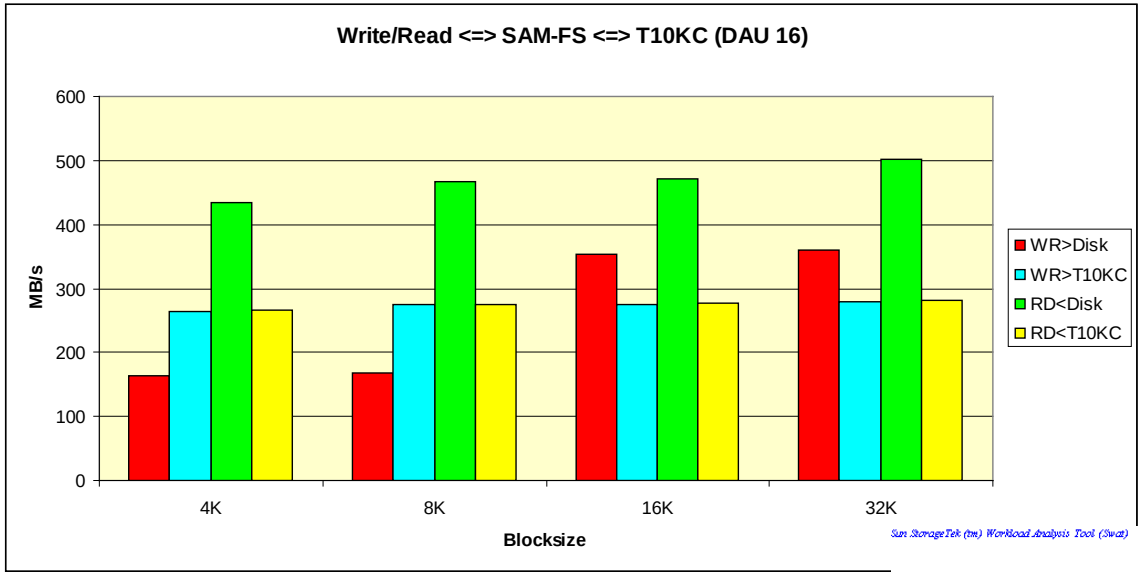
- TerraSar RAW Data and Products
- IRS-P3-RAW Data
- IRS-P3-MOS-RAW Data and Products
- ENVISAT RAW Data and Products

Measuring method:

Solaris 10
- /usr/bin/time
- Iostat
- swat

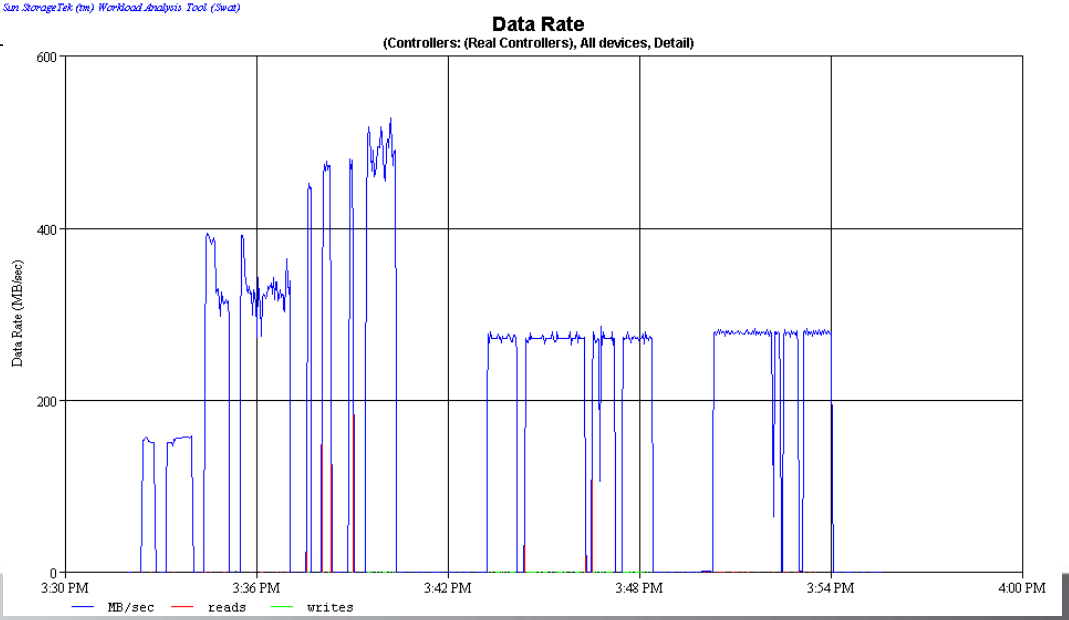
SAM-FS
- debugging and logging

Performance Test (Write/Read (SSD) SAM-FS/QFS calypso3)

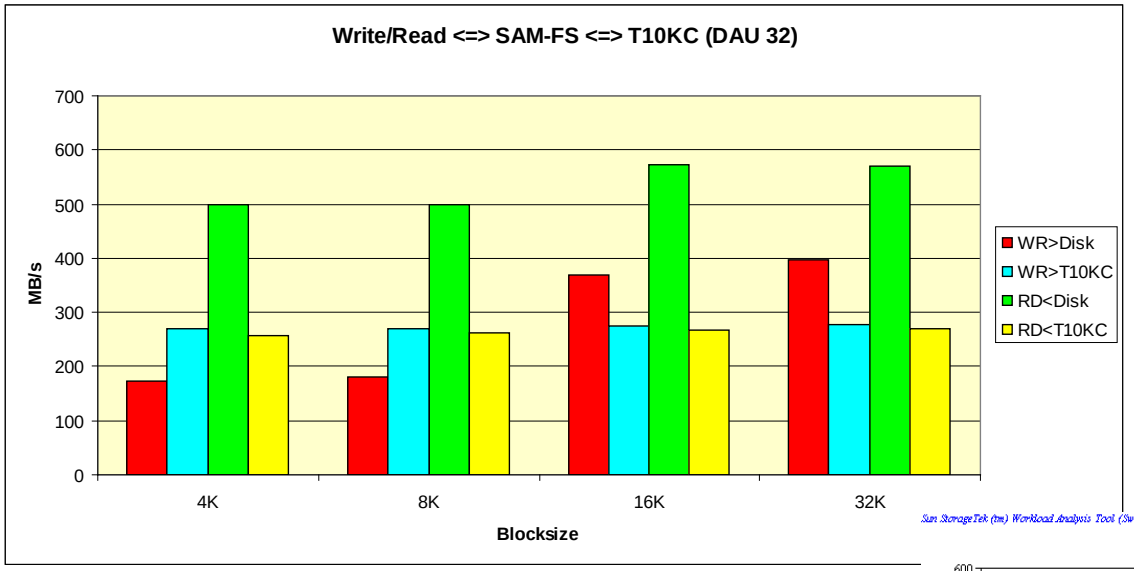


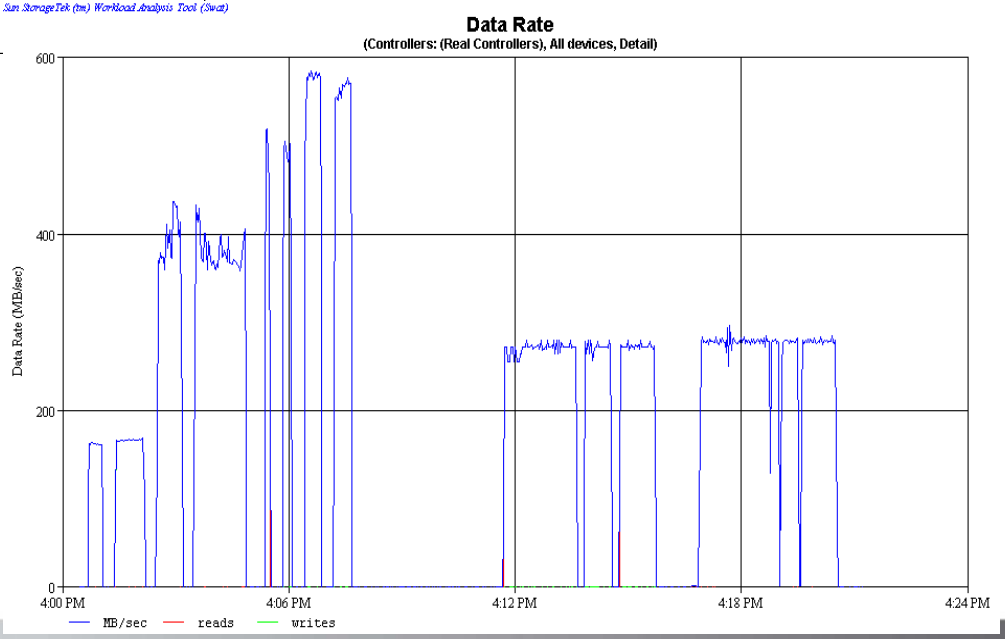
mcf-configuration file SAM-FS

```
flash 3 ms flash
/dev/dsk/c4t0d0s0  300  md  flash  -  # F20 Accelerator Card
/dev/dsk/c4t1d0s0  301  md  flash  -  # F20 Accelerator Card
/dev/dsk/c4t2d0s0  302  md  flash  -  # F20 Accelerator Card
/dev/dsk/c4t3d0s0  303  md  flash  -  # F20 Accelerator Card
```

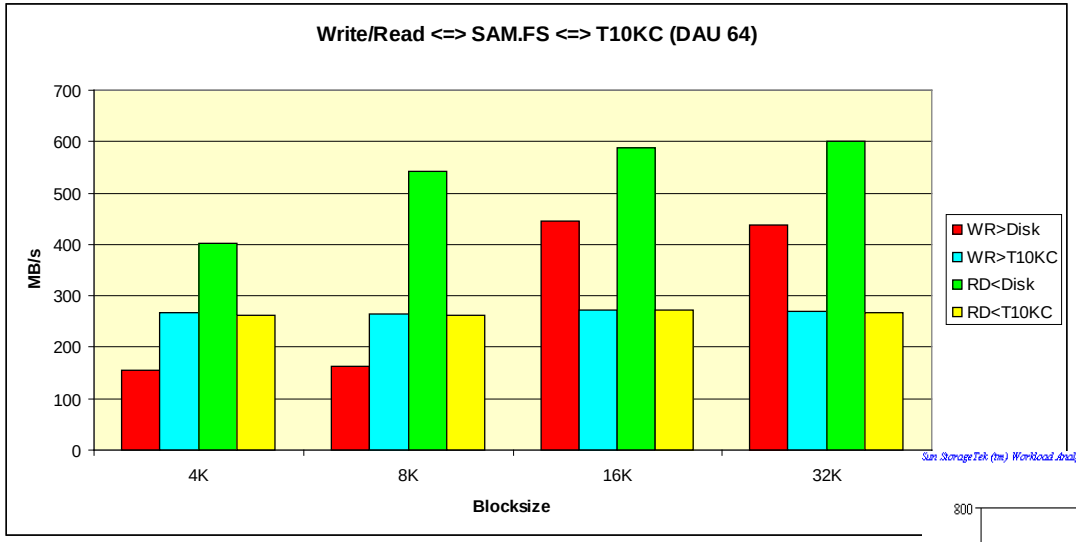


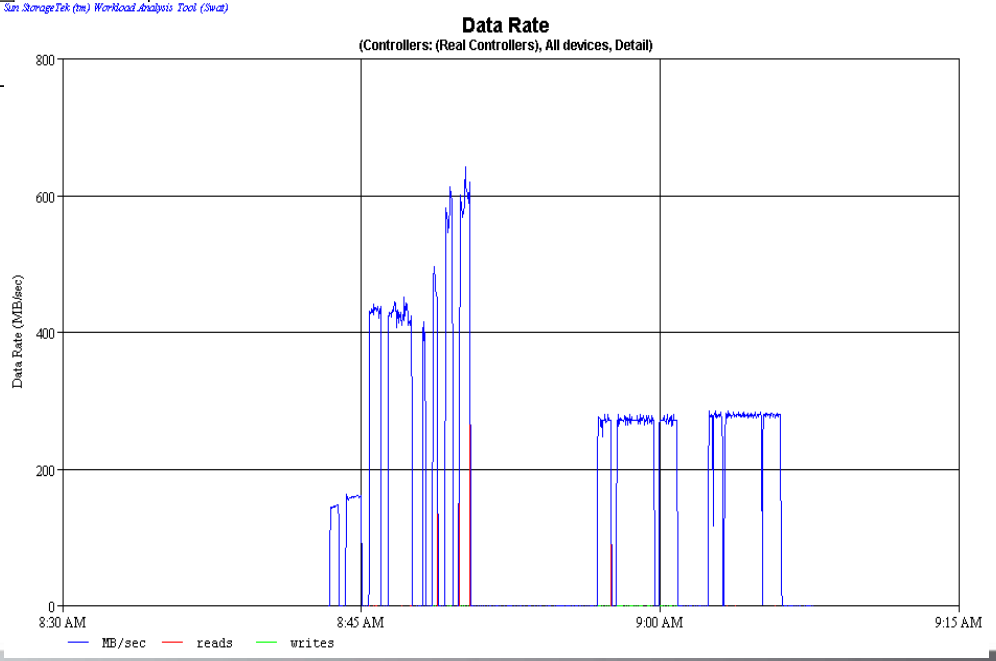
Performance Test (Write/Read (SSD) SAM-FS/QFS calypso3)





Performance Test (Write/Read (SSD) SAM-FS/QFS calypso3)



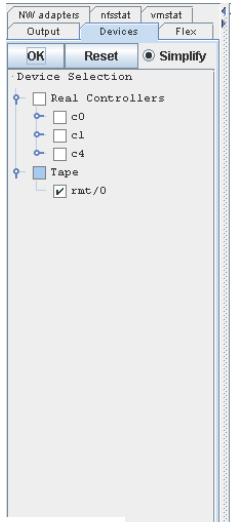


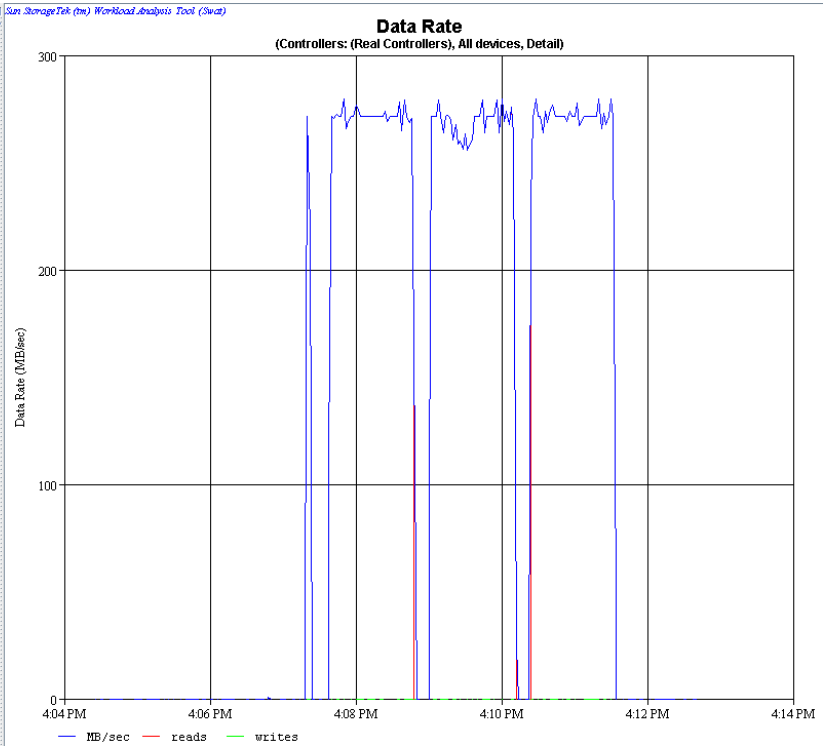
Performance Test

(Example Write SAM-FS/QFS => T10KC 3x20 GB Files)

extended device statistics

r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	1.5	0.0	60.8	0.0	0.0	0.0	0.1	0	0	c1t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t2d0
722.0	1.5	**70464**.0	24.0	0.0	5.3	0.0	7.4	0	27	c4t0d0
716.5	0.0	**70464**.0	0.0	0.0	5.3	0.0	7.4	0	27	c4t1d0
683.0	0.0	**70464**.0	0.0	0.0	5.1	0.0	7.4	0	27	c4t2d0
688.5	0.0	**70511**.8	0.0	0.0	5.2	0.0	7.6	0	27	c4t3d0
0.0	137.5	0.0	**281600**.1	0.0	1.0	0.0	7.3	0	100	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid586)

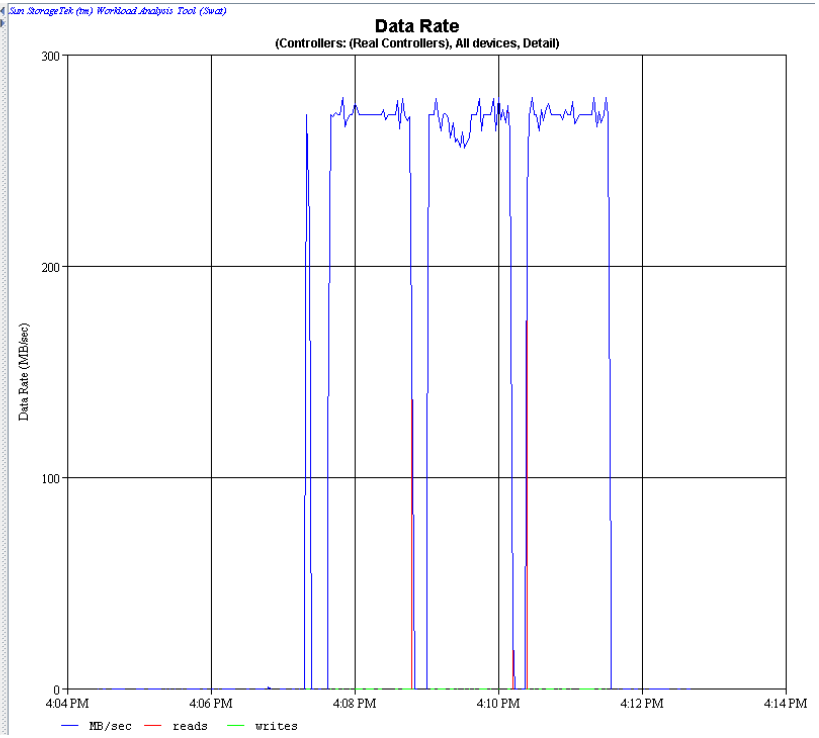




2011/03/17 16:06:05 1013 [2111:4] Slot 1: Ready time 0 seconds
2011/03/17 16:06:05 1006 [2111:4] Slot 1
2011/03/17 16:06:05 3122 [2111:4] Rewind time 0 seconds
2011/03/17 16:06:09 3003 [2111:4] Label TTC049 2011/03/15 12:57:51 blocksize = **2097152**
2011/03/17 16:07:16 3066 [2111:331] Positioning time: 67 seconds
2011/03/17 16:07:21 1066 [2111:331] Wrote 1098907648 bytes, time 4 seconds
2011/03/17 16:07:36 3066 [2111:332] Positioning time: 3 seconds
2011/03/17 16:08:47 1066 [2111:332] Wrote 20000538624 bytes, time 70 seconds
285721980,342 B/s = 272,485 MB/s
2011/03/17 16:08:58 3066 [2111:333] Positioning time: 1 seconds
2011/03/17 16:10:10 1066 [2111:333] Wrote 20000538624 bytes, time 71 seconds
281697727,098 B/s = 268,647 MB/s
2011/03/17 16:10:21 3066 [2111:334] Positioning time: 3 seconds
2011/03/17 16:11:32 1066 [2111:334] Wrote 20000538624 bytes, time 70 seconds
285721980,342 B/s = (272,485 MB/s)

Performance Test

(Example Read T10KC => SAM-FS/QFS 3x20 GB Files)



extended device statistics

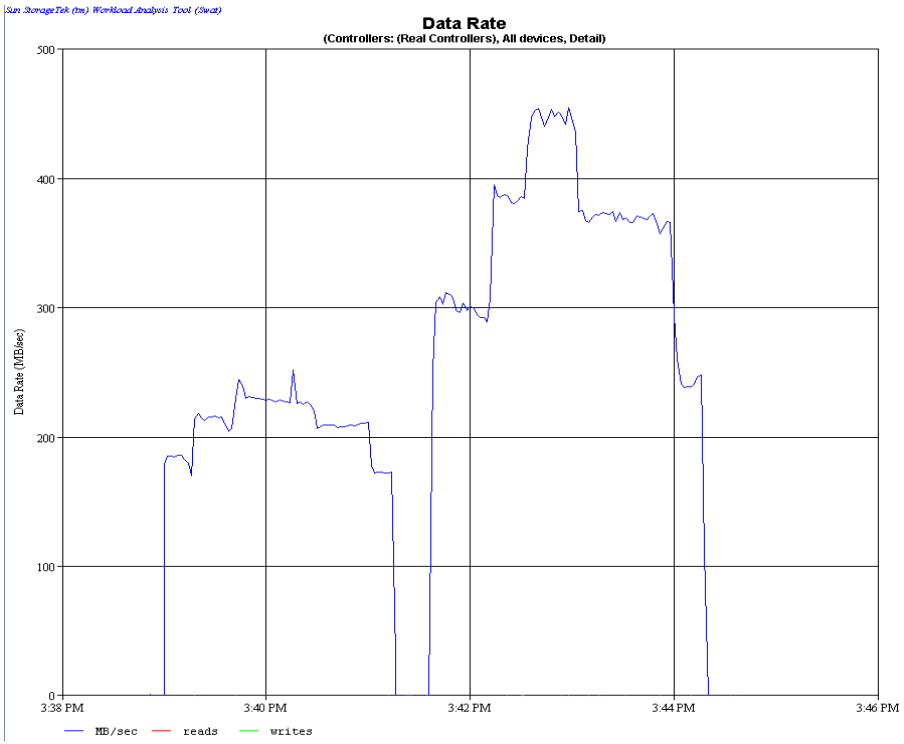
r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t2d0
0.0	566.5	0.0	**72449.9**	0.0	0.8	0.0	1.5	0	33	c4t0d0
0.0	566.0	0.0	**72449.6**	0.0	0.8	0.0	1.5	0	33	c4t1d0
0.0	566.0	0.0	**72449.6**	0.0	0.8	0.0	1.5	0	33	c4t2d0
0.0	566.0	0.0	**72449.6**	0.0	0.8	0.0	1.5	0	32	c4t3d0
141.5	0.0	**289798.6**	0.0	0.0	1.0	0.0	7.0	0	100	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid586)

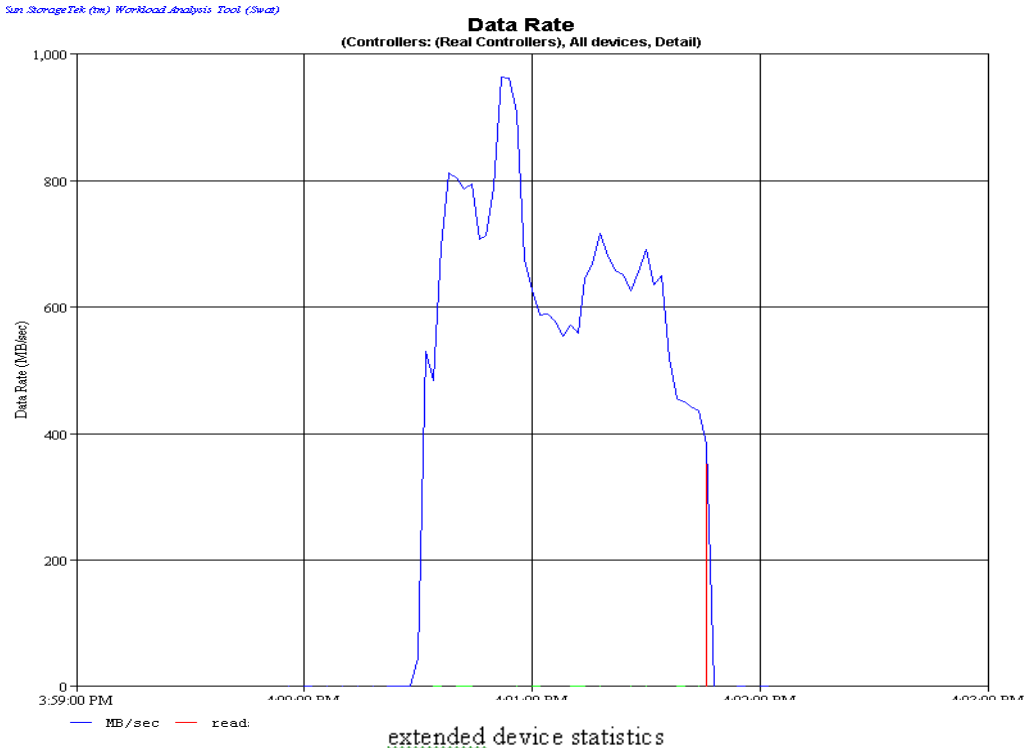
SAM-FS/QFS device-log:

2011/03/17 16:15:30 3066 [2111:4] Positioning time: 4 seconds
2011/03/17 16:19:01 1069 [2111:335] Read 60001615872 bytes, time 218 seconds
275236770,055 B/s = 262,486 MB/s

Performance Test

(Write/Read 3x20 GB Files <=>SAM-FS/QFS / parallel)



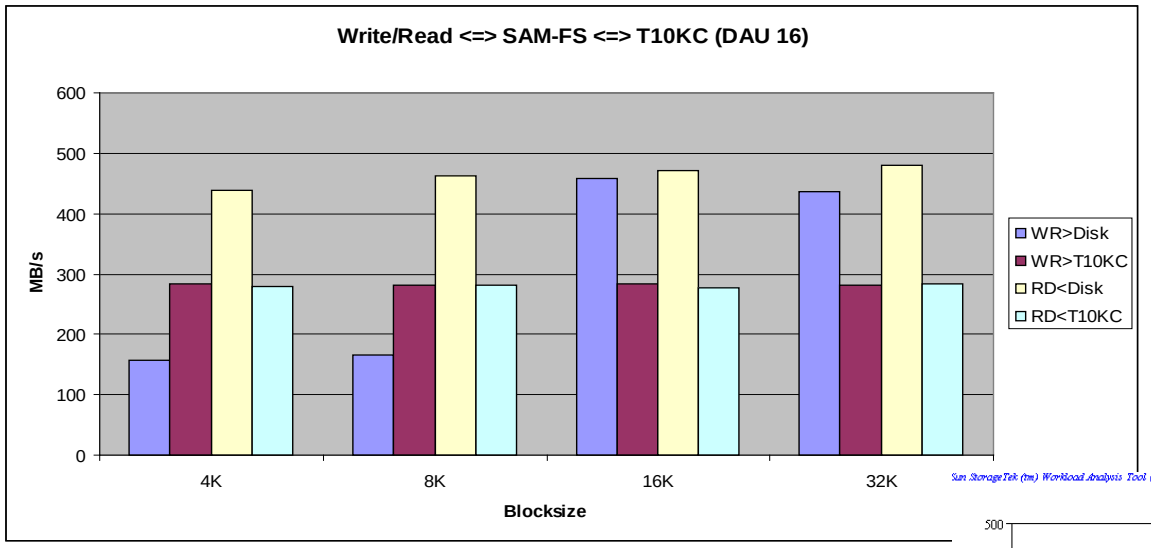


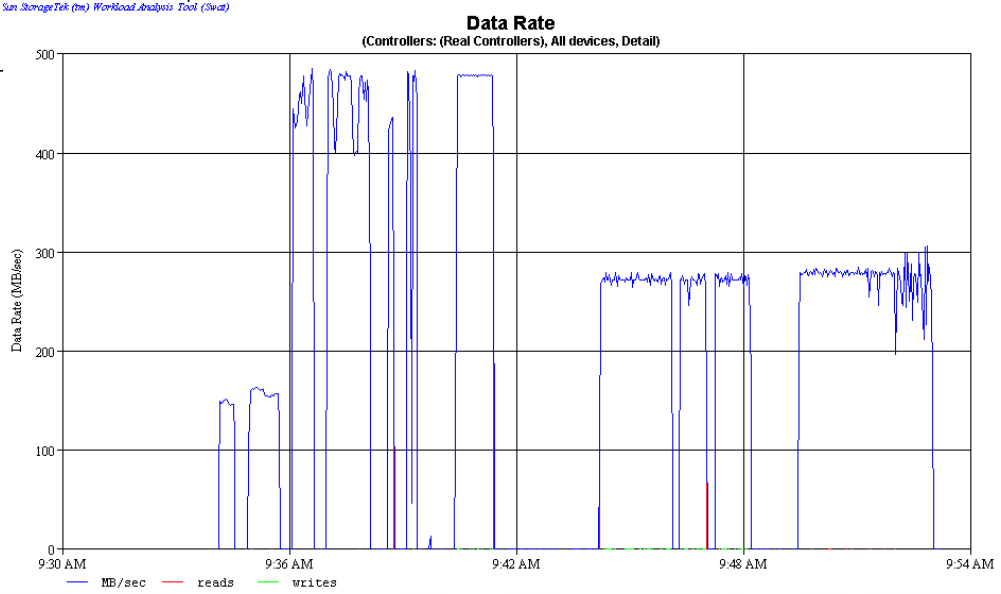
extended device statistics

r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	16.0	0.0	31.7	0.0	0.0	0.0	0.4	0	0	c1t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t2d0
2023.5	0.0	**199418.2**	0.0	0.0	2.7	0.0	1.3	1	**98**	c4t0d0
1858.0	0.0	**199402.2**	0.0	0.0	2.4	0.0	1.3	1	**98**	c4t1d0
1855.5	0.0	**199402.2**	0.0	0.0	2.5	0.0	1.3	1	**98**	c4t2d0
1895.5	0.0	**199418.2**	0.0	0.0	2.5	0.0	1.3	1	**98**	c4t3d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid586)

Performance Test

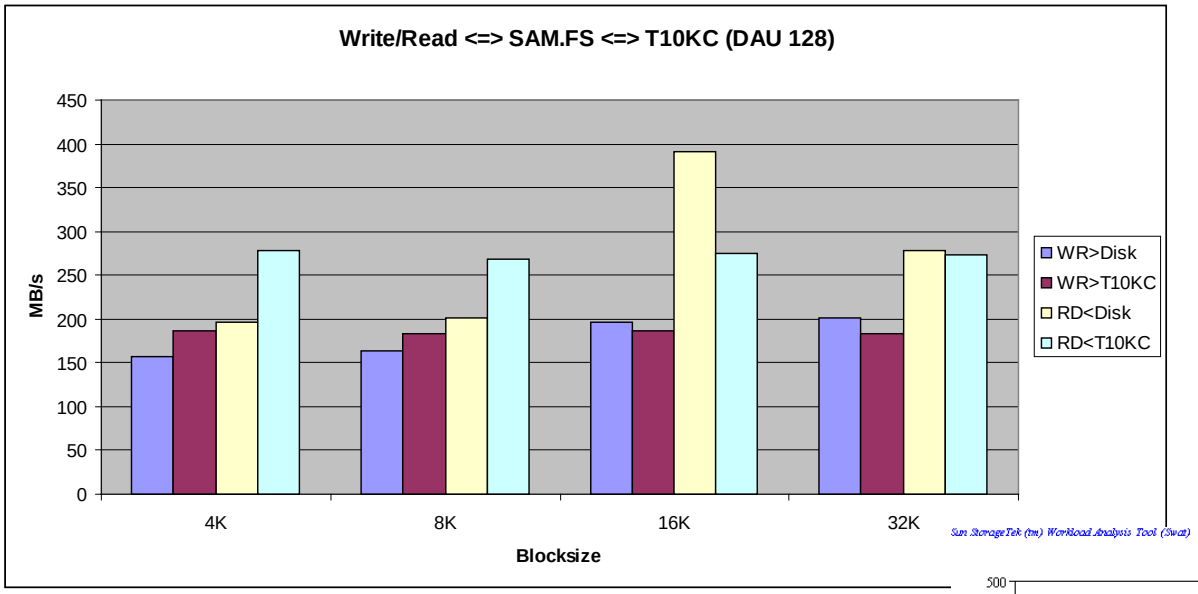
(Write/Read (6 internal SAS Disks Raid 0, with SAM) SAM-FS/QFS)

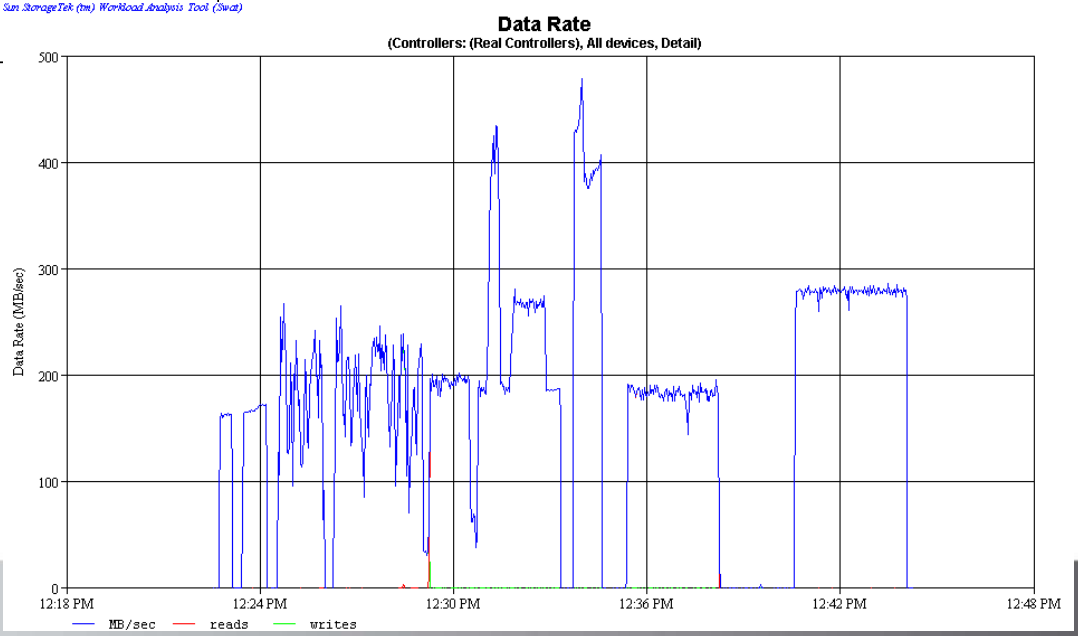




Performance Test

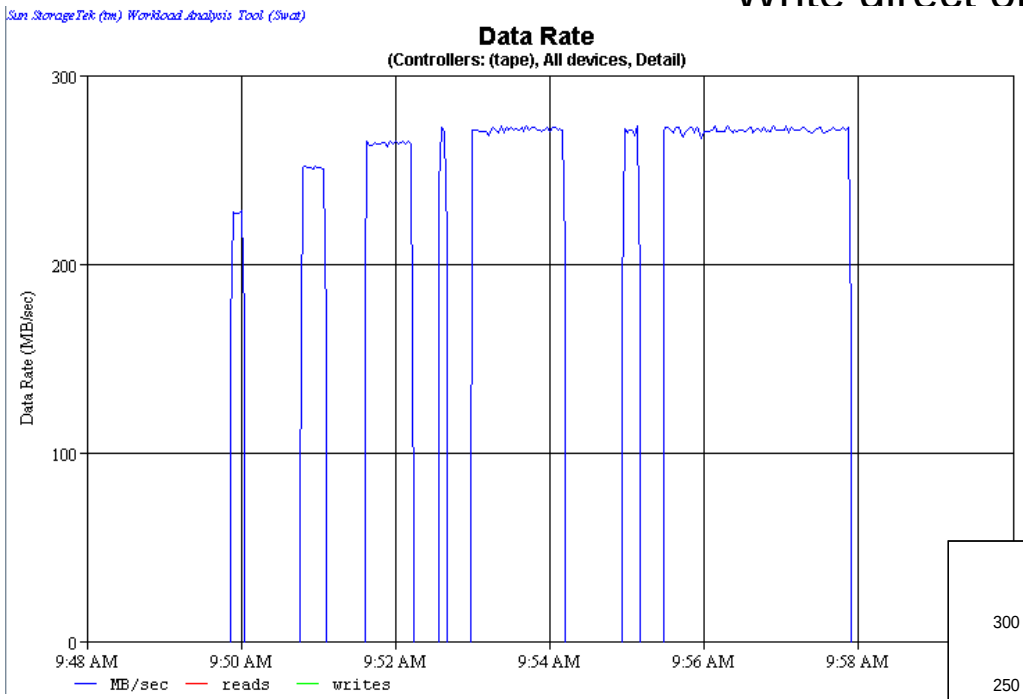
(Write/Read (6 internal SAS Disks Raid 0, with SAM) SAM-FS/QFS)



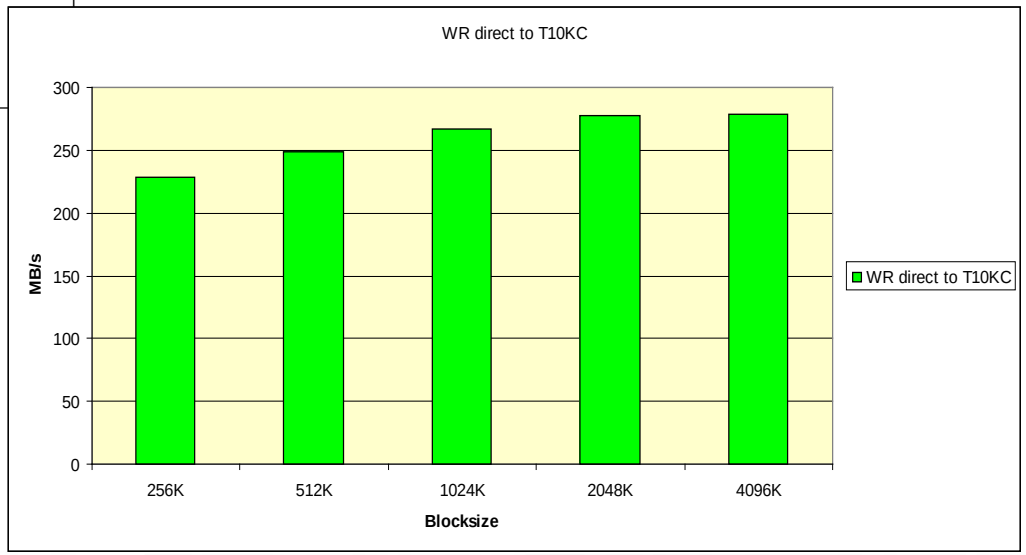


Performance Test

Write direct on tape drive

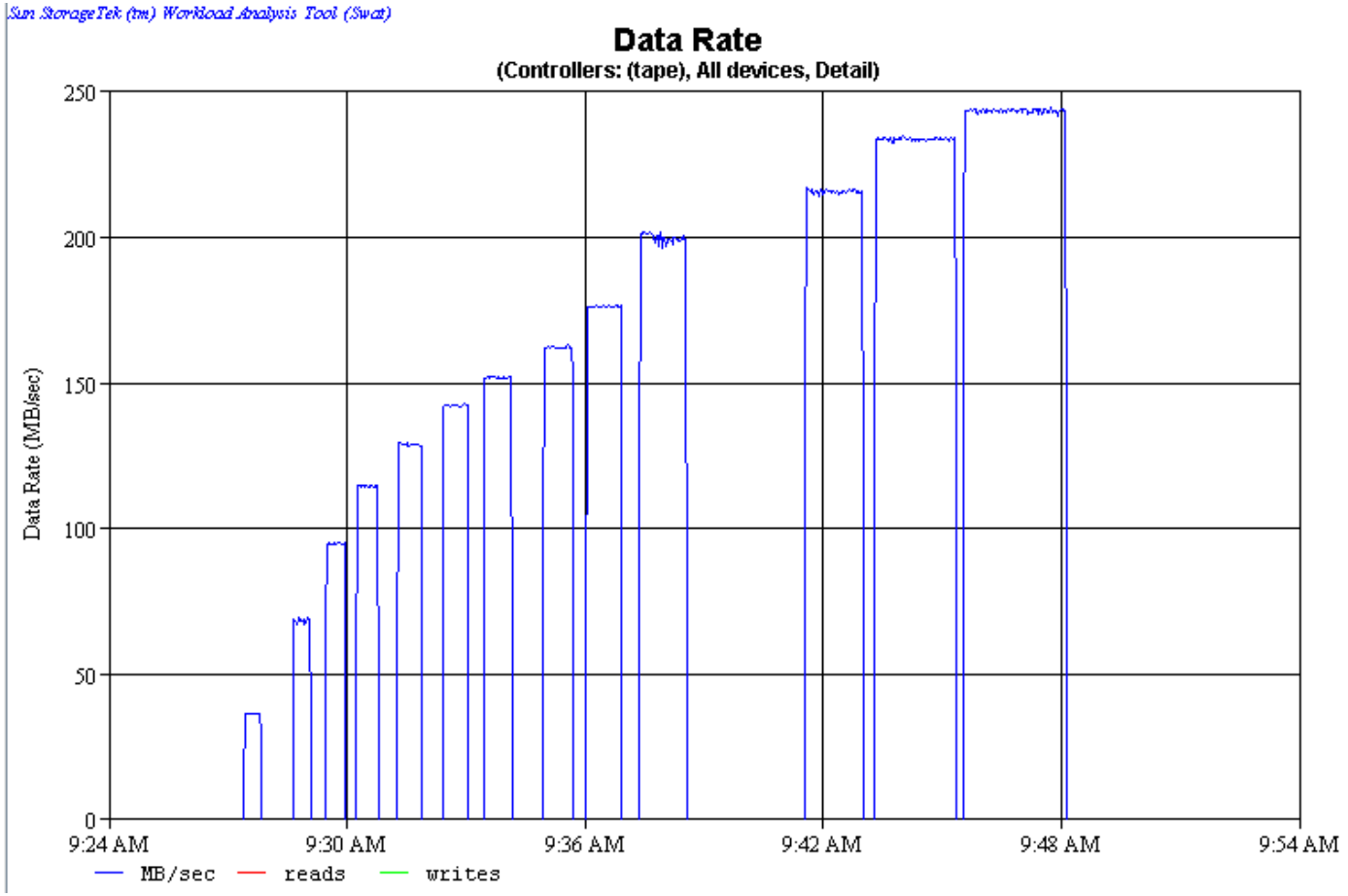


Blocksize: 256K, 512K, 1024K, 2048K, 2048K, 4096K, 4096K



Performance Test

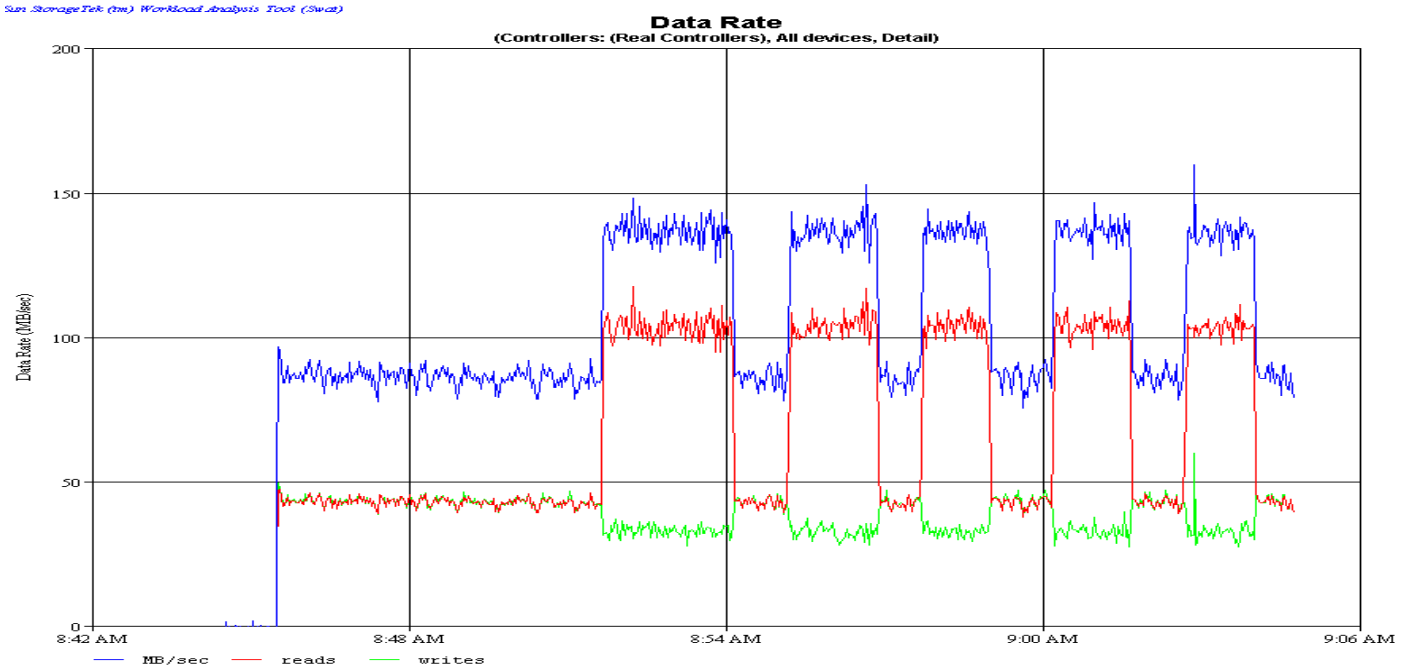
Write direct on tape drive



Blocksize: 20000B, 40000B, 50000B, 60000B, 70000B, 80000B, 100000B, 150000B, 200000B, 300000B, 400000B

Performance Test

Write/Read SAM-FS/QFS (bnbackup)



2011/04/20 07:24:53 1066 [6408:805] Wrote 5561647104 bytes, time 166 seconds
(31,95 MB/s)
2011/04/20 07:25:06 3066 [6408:806] Positioning time: 6 seconds
2011/04/20 07:27:20 1066 [6408:806] Wrote 4259315712 bytes, time 133 seconds
(30,54 MB/s) !!!!
2011/04/20 07:27:36 3066 [6408:807] Positioning time: 5 seconds
2011/04/20 07:29:06 1066 [6408:807] Wrote 5718933504 bytes, time 88 seconds
(61,97 MB/s)
2011/04/20 07:30:05 3066 [6408:808] Positioning time: 2 seconds
2011/04/20 07:31:51 1066 [6408:808] Wrote 6132072448 bytes, time 105 seconds
(55,69 MB/s)
2011/04/20 07:33:06 3066 [6408:809] Positioning time: 3 seconds

Performance Test

Capacity

Without compression:

(/dev/rmt/2bn 81 tp stk80 on #T10kC)

slot access time count use flags ty vsn

0 2011/04/16 03:29 64 **100%** -il-o-b----f ti TTC067

1 2011/04/16 12:27 55 42% -il-o-b----- ti TTC068

archive audit -f /tmp/listarch -v ./

ti TTC067 4411 files, **4357138921770** bytes, 0 damaged copies

ti TTC068 1799 files, 2064988926528 bytes, 0 damaged copies

With compression:

(/dev/rmt/c2bn 81 tp stk80 on #T10kC)

slot access time count use flags ty vsn

0 2011/04/18 12:57 66 **100%** -il-o-b----- ti TTC067

1 2011/04/20 05:52 57 7% -il---b----- ti TTC068

archive audit -f /tmp/listarch -v ./

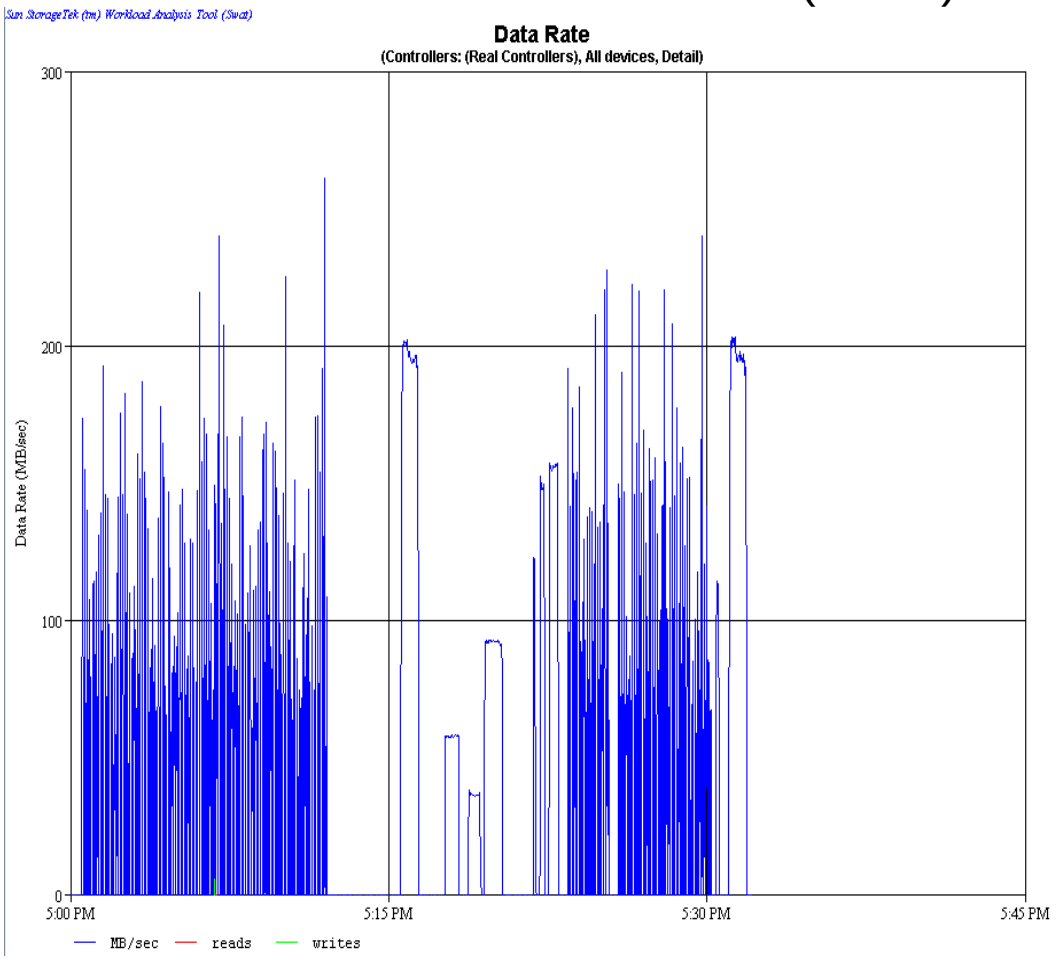
ti TTC067 5582 files, **5721930759662** bytes, 0 damaged copies

ti TTC068 346 files, 399661652950 bytes, 0 damaged copies

Compression factor1:1.31

Performance Test

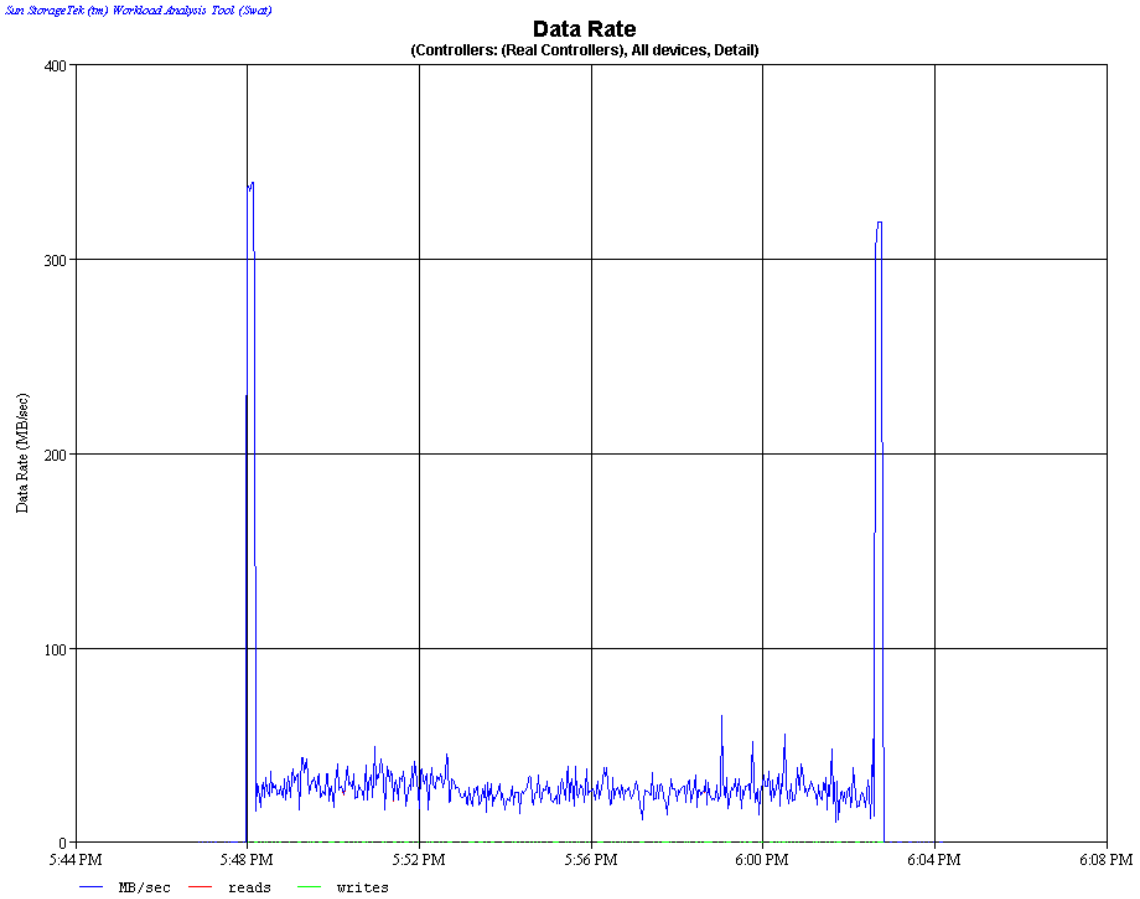
Write/Read Hardware Raid 0 (6 disk) X4140 <=>SAM-FS/QFS (parallel)



r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t0d0
0.0	23.5	0.0	46.0	0.0	0.3	0.0	11.9	0	26	c1t1d0
0.0	301.6	0.0	154405.2	367.1	136.9	1217.2	453.9	100	62	c1t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t3d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid586)

Performance Test

Write/Read Hardware Raid 0 (6 disk) X4140 <=>SAM-FS/QFS (parallel)



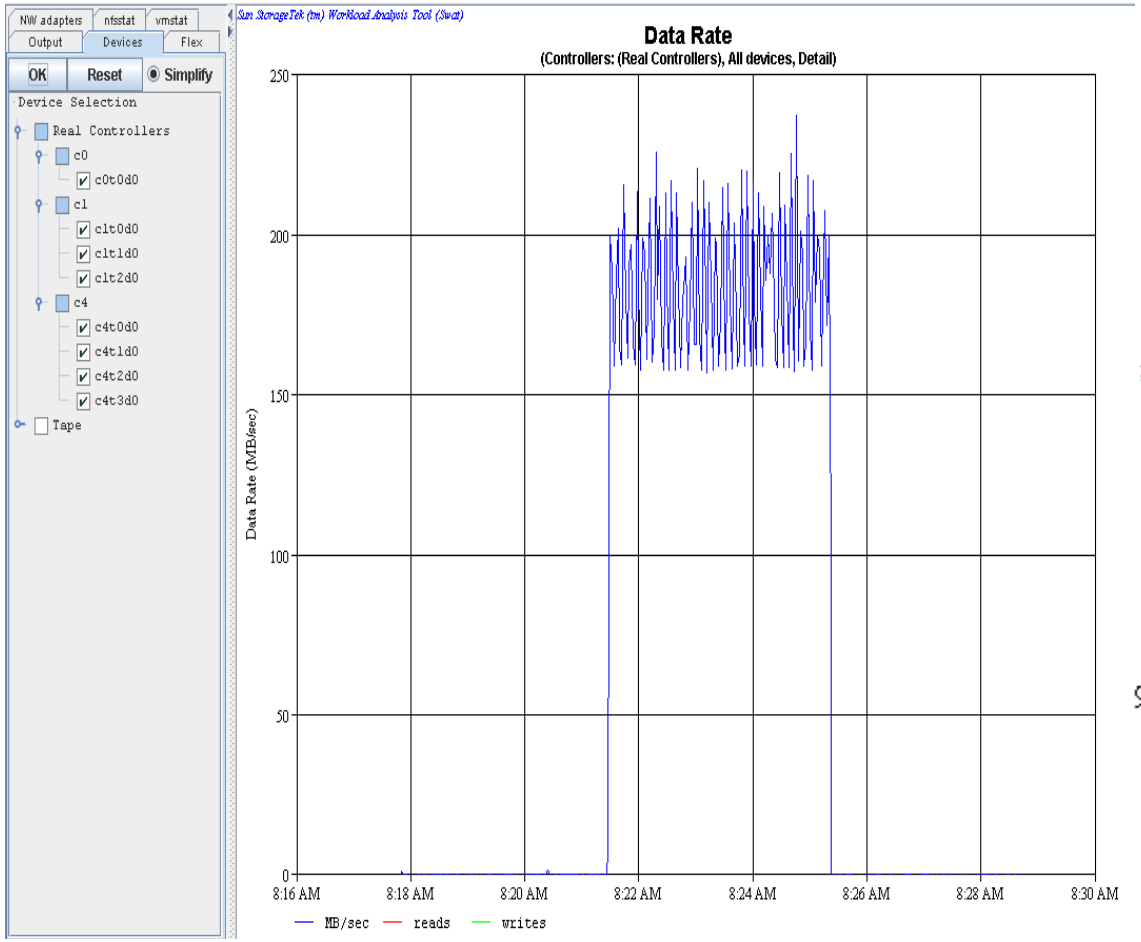
Lesen: 3xdd:

extended device statistics

r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t1d0
556.5	0.0	**40735.6**	0.0	0.0	45.1	0.0	81.1	0	**100**	c1t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t3d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid586)

Performance Test

Read T10KC => Hardware Raid 0 (6 disk) X4140 <=>SAM-FS/QFS

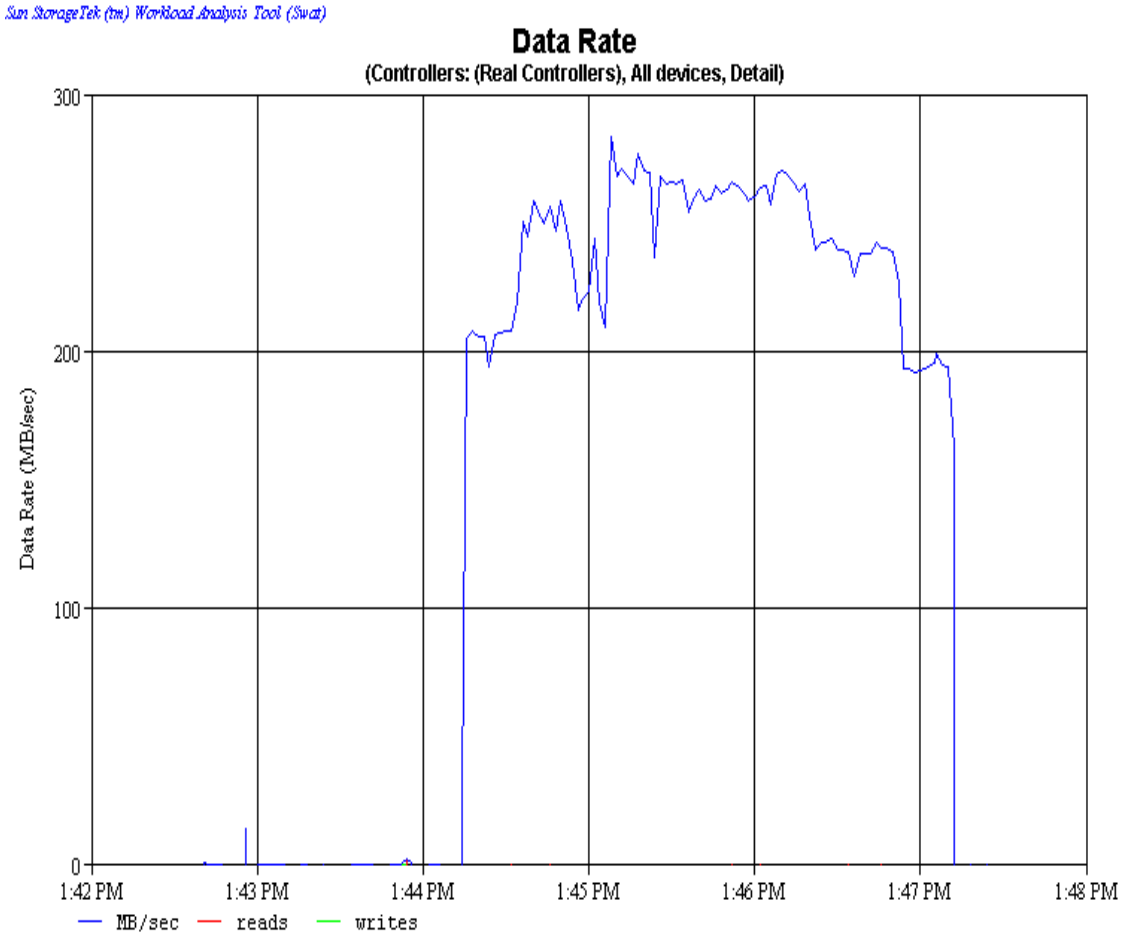


extended device statistics

r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	0.5	0.0	2.0	0.0	0.0	0.0	0.1	0	0	c1t0d0
0.0	0.5	0.0	0.2	0.0	0.0	0.0	0.1	0	0	c1t1d0
0.0	194.0	0.0	**198655.1**	0.0	1.0	0.0	5.1	1	73	c1t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t3d0
99.5	0.0	**203775.2**	0.0	0.0	0.7	0.0	7.2	0	72	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid586)

Performance Test

Write/Read SAM Raid 0 (6 disk) X4140 <=>SAM-FS/QFS (parallel)

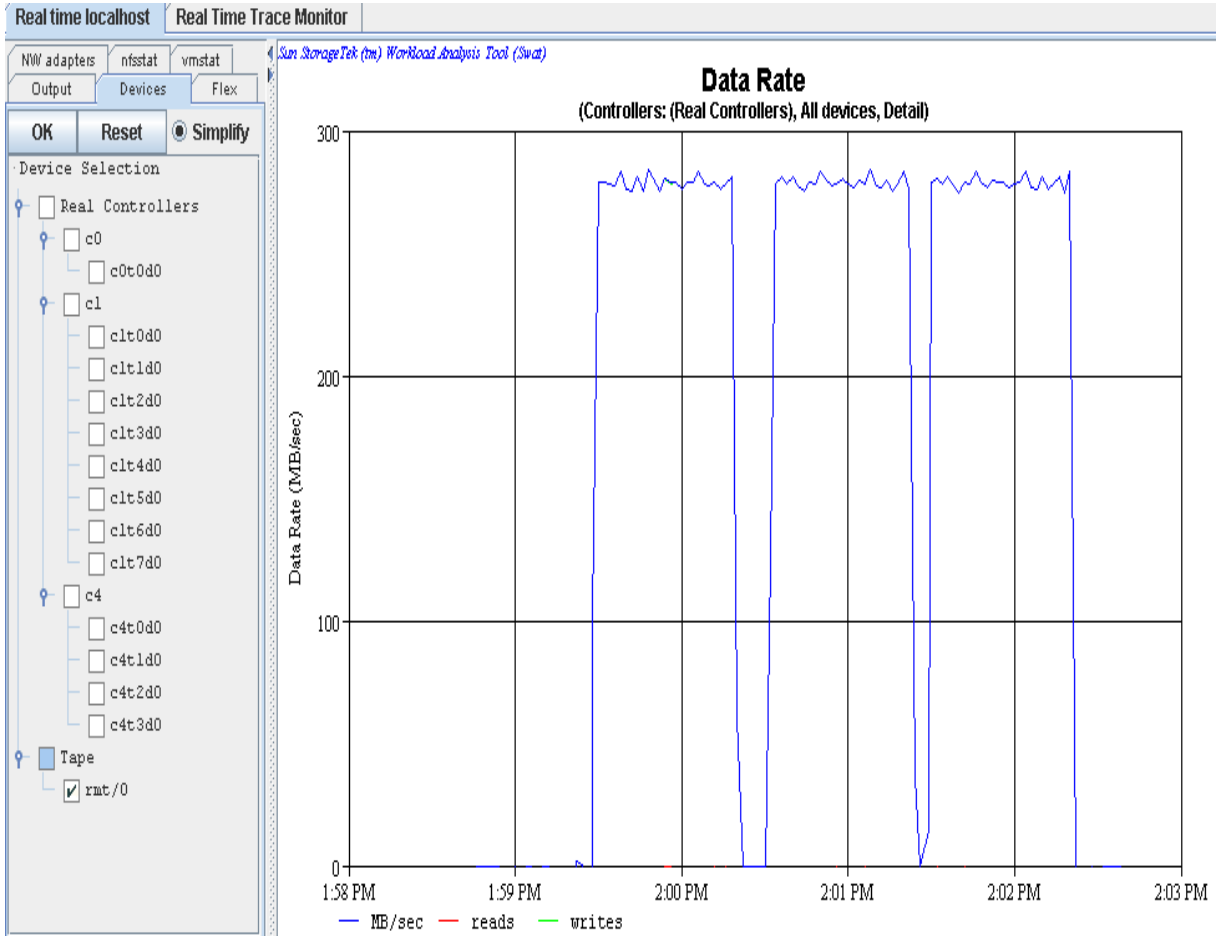


extended device statistics

r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	0.5	0.0	32.0	0.0	0.0	0.0	0.2	0	0	c1t0d0
0.0	130.0	0.0	167.5	0.0	0.6	0.0	4.9	0	40	c1t1d0
0.0	278.5	0.0	**45824.1**	0.0	0.5	0.0	1.8	0	19	c1t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t3d0
0.0	268.5	0.0	**45320.1**	0.0	0.6	0.0	2.3	0	20	c1t3d0
0.0	267.0	0.0	**45568.2**	0.0	0.7	0.0	2.6	0	20	c1t4d0
0.0	270.0	0.0	**46072.2**	0.0	0.7	0.0	2.7	0	30	c1t5d0
0.0	277.0	0.0	**46740.1**	0.0	0.9	0.0	3.1	0	36	c1t6d0
0.0	277.5	0.0	**45916.2**	0.0	0.6	0.0	2.2	0	31	c1t7d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid552)

Performance Test

Read T10KC => SAM Raid 0 (6 disk) X4140 <=>SAM-FS/QFS

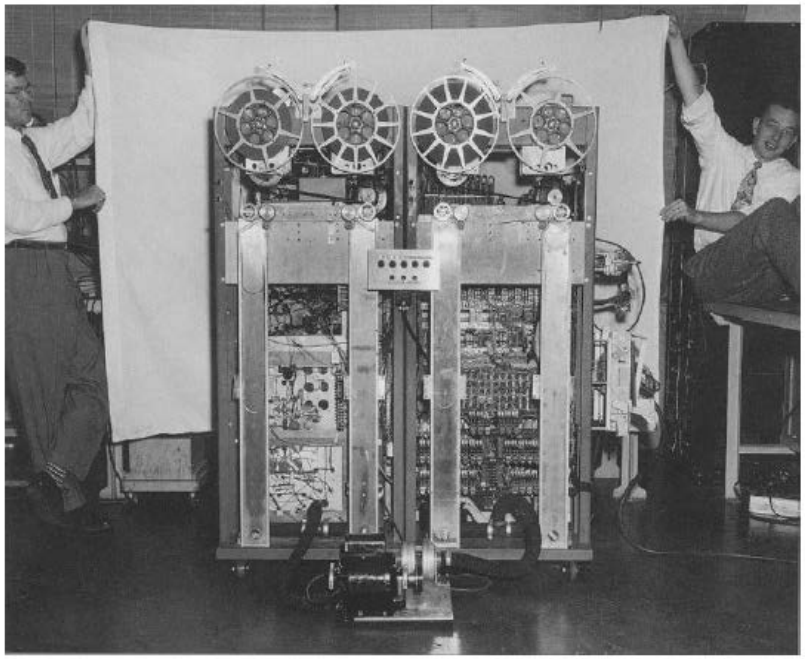


extended device statistics

r/s	w/s	kr/s	kw/s	wait	actv	wsvc_t	asvc_t	%w	%b	device
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c0t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c1t0d0
0.0	0.5	0.0	0.2	0.0	0.0	0.0	0.1	0	0	c1t1d0
0.0	95.5	0.0	**48895.8**	0.0	0.2	0.0	2.4	0	23	c1t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t0d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t1d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t2d0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	c4t3d0
0.0	95.5	0.0	**48895.8**	0.0	0.3	0.0	2.6	0	25	c1t3d0
0.0	95.5	0.0	**48895.8**	0.0	0.2	0.0	2.1	0	20	c1t4d0
0.0	95.5	0.0	**48895.8**	0.0	0.2	0.0	2.4	0	23	c1t5d0
0.0	96.0	0.0	**49151.8**	0.0	0.2	0.0	2.4	0	23	c1t6d0
0.0	96.0	0.0	**49151.8**	0.0	0.3	0.0	2.6	0	25	c1t7d0
142.5	0.0	**291839.1**	0.0	0.0	1.0	0.0	7.0	0	100	rmt/0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	calypso3:vold(pid552)

Conclusion

Das erste Bandsystem kam von IBM



....am Anfang 1952:

IBM Tape Drive Modell 726
- 100 BPI
- 12 Zoll Rollenband
- 720 m Länge
- Speicherkapazität 1.4 MB
- Gemeinschaftsentwicklung des Mediums mit 3M (heute Imation)

Thanks