

1/2" Tape Partitioning

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1/2" TAPE PARTITIONING

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Introduction

- ◆ Tape partitioning implementation in a 3480/90 style cartridge tape unit
- ◆ Overcoming the physical limitation of 3480/90 cartridges

Presentation Topics

1. Problems:
 - Capacity
 - Cost of Media
 - Utilization of Media Space
2. Drive Capabilities
3. Cartridge Limitations
4. Partitioning Implementations
 - 12-step model
 - 6-step model
 - Variable (n -Partition) Model - Best Solution
5. Application Benefits

Capacity Problems

- ◆ Capacity - 200 MBytes \implies 20 GBytes
 - 18-track 200 MBytes (3480)
 - 36-track 800 MBytes (3490E)
 - *n*-track 20 GBytes (3480 MP++ media cartridge)

Cost Problem

Cartridge Type	Cost Of Media	Capacity Megabytes	Cents Per MB
3480	\$5.00	200	2.5¢
3490E	\$13.00	800	1.6¢
Nxxx	\$70.00	20,000	0.35¢

Utilizing all available capacity!!

Utilization Assumptions

- ◆ Backup volume of 1.3 GBytes
- ◆ Non-compressible data

The Utilization Issue

Cartridge Type	Number Required	Media Cost	Cents Per MB	Utilization Percentage
3480	7	\$35	2.7¢	93%
3490E	2	\$26	2.0¢	81%
Nxxx	1	\$70	5.4¢	6.5%

Partitioning Can Overcome This Utilization Problem

Nxxx Drive Capabilities

- ◆ Uses 3480 form factor cartridges
- ◆ 1700 foot MP++ media, 0.3 mil
- ◆ Records n - steps, 18 tracks, parallel serpentine
- ◆ Bi-directional Read/Write
- ◆ Read/Write speed is 2 ms (80 ips)
- ◆ Locate/Rewind speed is 4 ms (160 ips)

Nxxx Drive Capabilities (cont'd)

- ◆ Drive Adjusts for Tape Length and Radius Variations
- ◆ 10 MBs Data Rate (Sustained, Native)
- ◆ Load Time Less Than 20 Seconds
- ◆ Uses SCSI II Command Set

Cartridge Limitations

- ◆ 3480 Cartridge is single ended
- ◆ Must rewind all media into cartridge for unload
- ◆ Partitioning could be based on BOT or on EOT

12-Step Partition Model

- ◆ 12 Partitions, 1 partition per step
- ◆ Partition size is 1.7 GBytes
- ◆ Beginning/End of partition is defined by BOT/EOT
- ◆ 78% Utilization, using 1.3 GByte volume sets

12 Step Model Problems

- ◆ Utilization better, cost is 0.4 cents per MByte, but
- ◆ Load to odd partitions is at hub-end of tape.
 - Load time = 130 seconds
- ◆ Unload from even partitions is from leader block end of tape
 - Unload time = 130 seconds

6 Step Partition Model

- ◆ 6 Partitions, 1 partition per 2 steps
- ◆ 3.3 GBytes Partition size
- ◆ Beginning/End of partition defined by Leader block end of tape
- ◆ 39% Utilization (1.3 GByte volume sets)
- ◆ This scheme avoids load/unload time issues (load to BOT, Unload from EOT)

6 Step Model Problem

- ◆ Utilization is going in wrong direction
- ◆ Cost per MByte doubles to 0.9 cents

n-Partition Model Solution

- ◆ Allows a variable number of partitions
 - Host selectable, up to 256 Initiator Defined Partitions
 - » Min 78 MBytes, Max = 20 GBytes
 - Target default, 100 Target Defined Partitions
 - » Partition size = 200 MBytes
- ◆ Solves utilization and cost issues
- ◆ Host controls media utilization.

Restore Speed Issue

- ◆ Search for block on 1700' tape @ 2 m/sec (read speed) equals 60 min
- ◆ Search using high speed locate (4 m/sec) equals 30 minutes
- ◆ Search using stepping to correct serpentine track, then high speed locate is about 130 seconds
- ◆ Requires that the host maintain location information external to cartridge

Restore Speed Issue Solution

On-Tape Indexing

- ◆ Unit maintains positioning information:
 - Logical position
 - » Partition number
 - » Logical block address (LBA)
 - Physical Position
 - » Step (Serpentine position)
 - » Tach count (wrap)

Restore Speed Solution (cont'd)

- ◆ Unit performs an internal READ POSITION as Partition and File Marks are written
- ◆ Unit maintains/updates this information as long as cartridge is loaded
- ◆ On unload, this positioning data is written to a reserved area

Restore Speed Solution (cont'd)

- ◆ On subsequent reload, this data is restored to internal memory; the logical to physical map is now reestablished without host intervention
- ◆ Unit does not have to 'remap' the cartridge while loading

On-Tape Indexing Benefits

- ◆ Result is an average LOCATE time of less than 35 seconds (after load)
- ◆ No vendor unique SCSI command implementations are required

Application Benefits

- ◆ Backup Data Sets (Full Media Usage)
- ◆ Restore Data Sets (Speed of Access)
- ◆ Data Mines (HSM, Volume Stacking)
- ◆ Broadcast Industry (Pseudo-Random access to a sequential device, video on demand)