DLTtape™ Technology, Reliability, Performance and Future

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DLT™ Tape Drives

DLT™ Technology

DLT™ Reliability Features

DLT™ Performance

Future Directions

What is DLT Technology

I. **Linear recording**

II. **Cartridge tape**

III. **Capacity & Throughput**

IV. **Reliability**

V. **Backwards compatibility**

There are three DLT drives

	DLT2000XT	DLT4000	DLT7000
Capacity(GB,native)	**15**	**20**	**35**
Data rate(MB/s,native)	**1.25**	**1.5**	**5**
Bit density (Kbpi)	**62.5**	**82.5**	**86.0**
Track density (tpi)	**256**	**256**	**416**
Media type	**MP-1**	**MP-2**	**MP-2**
Media length	**1800’**	**1800’**	**1800’**
Recording channels	**2**	**2**	**4**
Data compression	**Yes**	**Yes**	**Yes**
Interface	**SCSI-2**	**SCSI-2/F**	**SCSI-2/FW**

Linear Recording

```
Track 2   | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |  ---→
Track 1   | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |  ←--
Track 0   | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |  ---→
```

DLT4000 Track Format

```
Track 4  \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\   -→
Track 3  ///////////////////////////////////////////////  ←-
Track 2  \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ -→
Track 1  /////////////////////////////////////////////// ←-
Track 0  \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\  -→
```

DLT7000 Track Format

DLT7000 track format is called Symmetric Phase Recording.

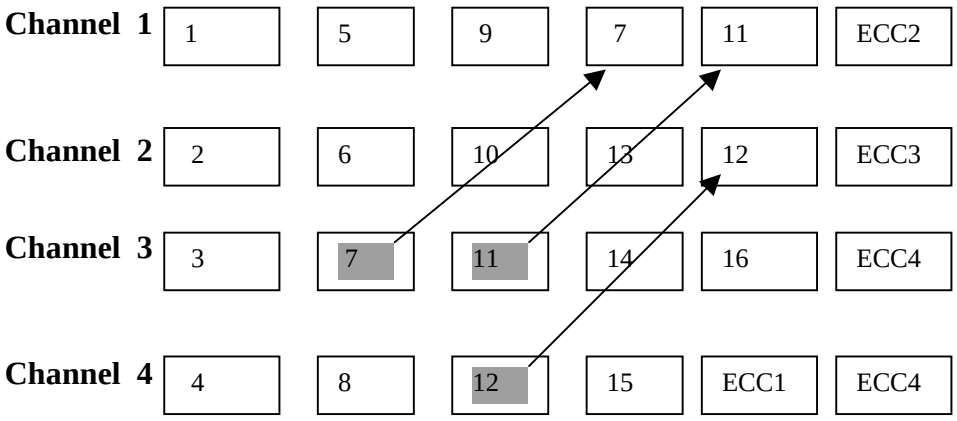
It eliminates the need for guard bands and increases the track density.

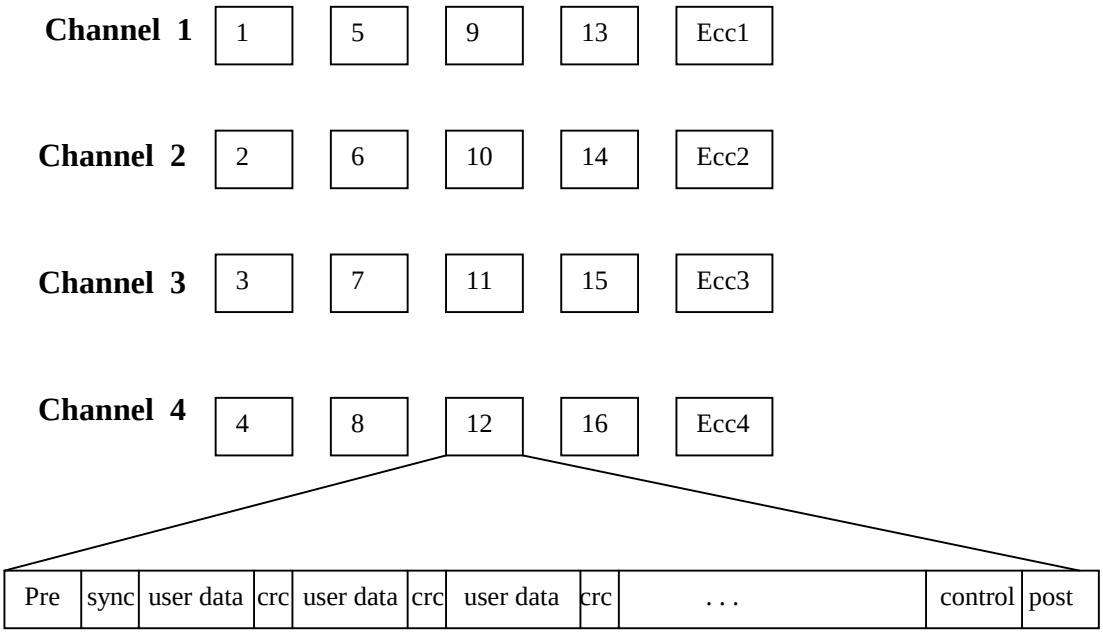
Reliability

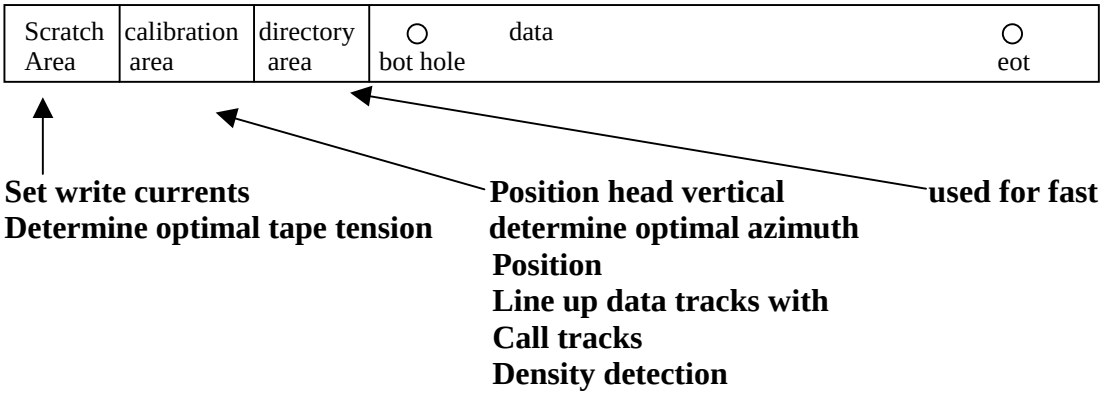
	DLT7000	DLT4000	DLT2000XT
No. of Passes	**1,000,000**	**1,000,000**	**500,000**
Head Life	**30,000 Hrs**	**10,000 Hrs**	**30,000 Hrs**
Media Life	**30 years**	**30 Yrs**	**30 Yrs**
Drive MTBF	**200,000 Hrs**	**200,000 Hrs**	**200,000 Hrs**

For FY98

	# Sold	# returned
Tape III	**1,000,576**	**0**
Tape IIIXT	**1,455,648**	**3**
Tape IV	**3,666,032**	**12**


Channel 1
1
5
9
7
11
ECC2
Channel 2
2
6
10
13
12
ECC3
Channel 3
3
7
11
14
16
ECC4
Channel 4
4
8
12
15
ECC1
ECC4


Channel 1
1
5
9
13
Ecc1
Channel 2
2
6
10
14
Ecc2
Channel 3
3
7
11
15
Ecc3
Channel 4
4
8
12
16
Ecc4
Pre
sync
user data
crc
user data
crc
user data
crc
. . .
control
post


Scratch Area
calibration area
directory area
bot hole
data
eot
Set write currents
Determine optimal tape tension
Position head vertical
determine optimal azimuth
Position
Line up data tracks with
Call tracks
Density detection
used for fast search

Performance

Performance

- **Throughput**
- **Response Time**

Workload

- **Interactive**
- **Batch**
- **Network**

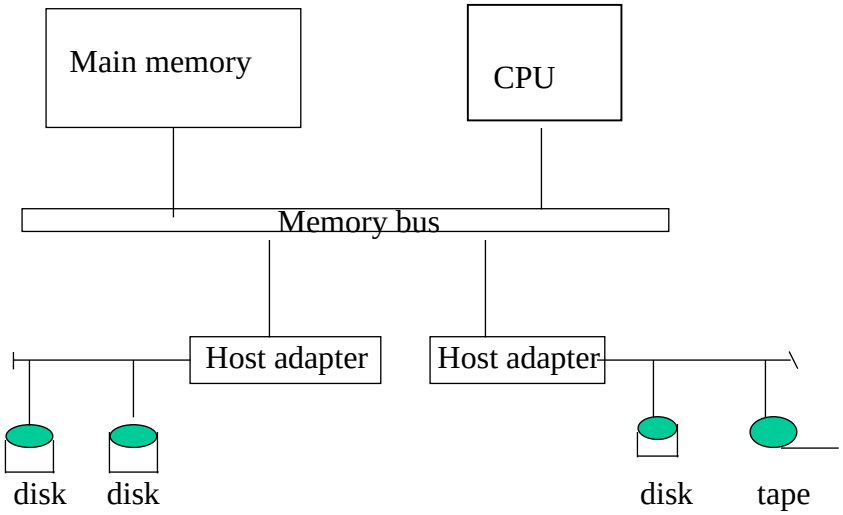


Fig. 1

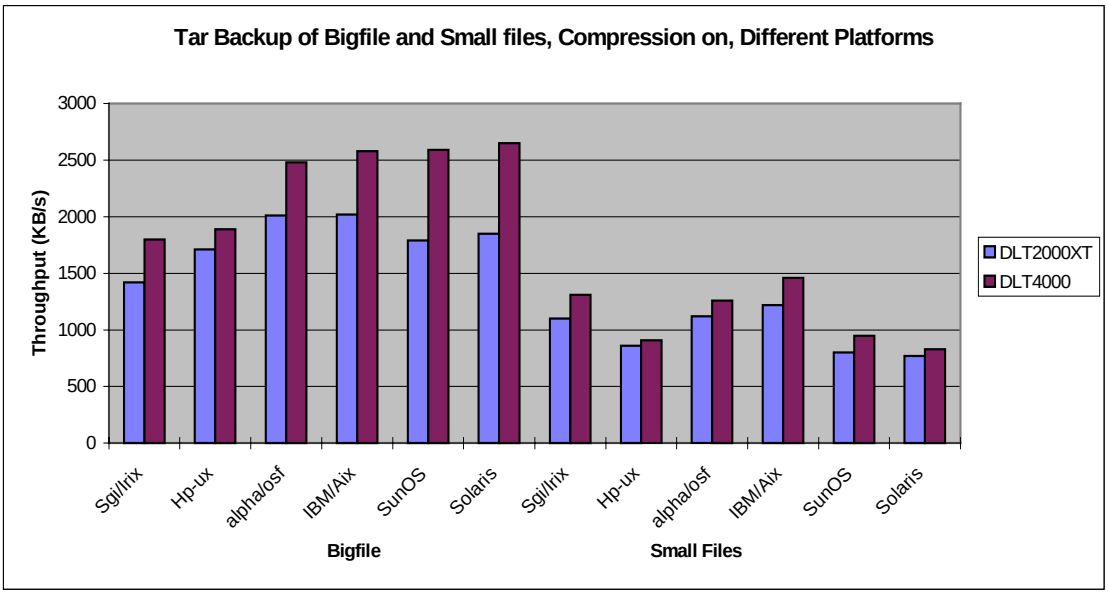
When workload increases,

CPU,
Memory,
Memory Bus,
Host Adapter,
I/O Bus,
I/O Device, or
Network

may become a bottleneck.

DLT2000XT AND DLT4000

	Sgi/Irix	Hp-ux	alpha/osf	IBM/Aix	SunOS	Solaris	Sgi/Irix	Hp-ux	alpha/osf	IBM/Aix	SunOS	Solaris
DLT2000XT	1420	1710	2010	2020	1790	1850	1100	860	1120	1220	800	770
DLT4000	1800	1890	2480	2580	2590	2650	1310	910	1260	1460	950	830



DLT7000

Operational Characteristics

Fixed Block Mode

Variable Block Mode

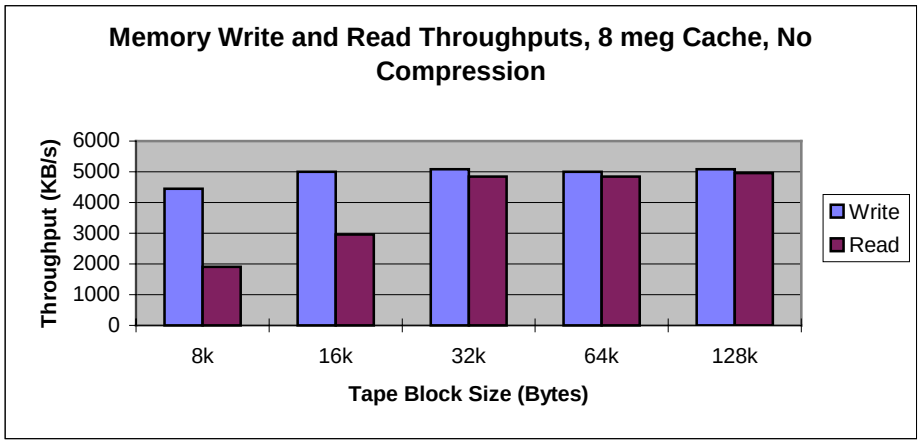
Performance Mode

Capacity Mode

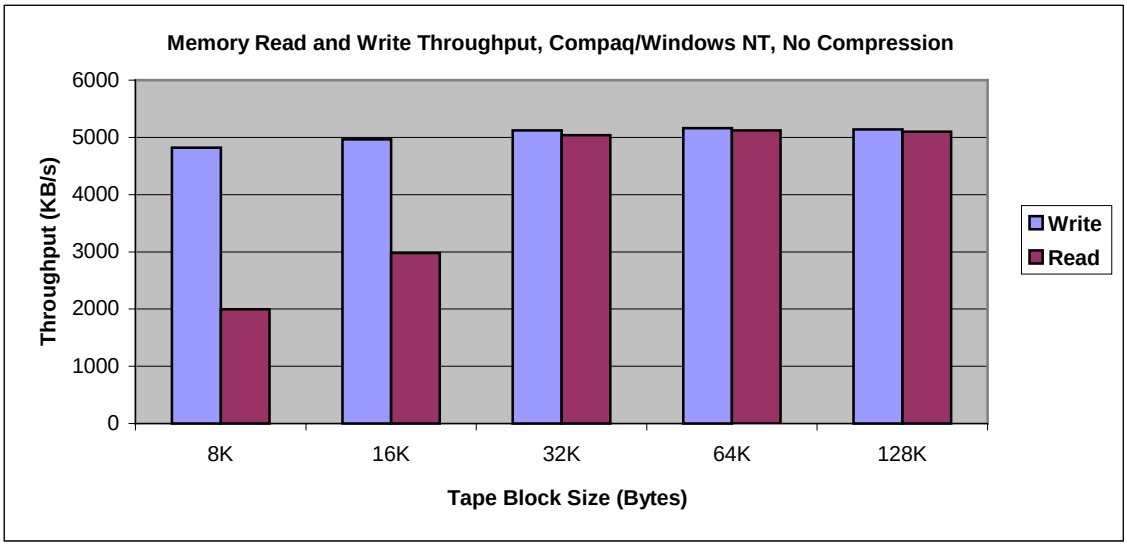
Tape Block Size

Compression Ratio

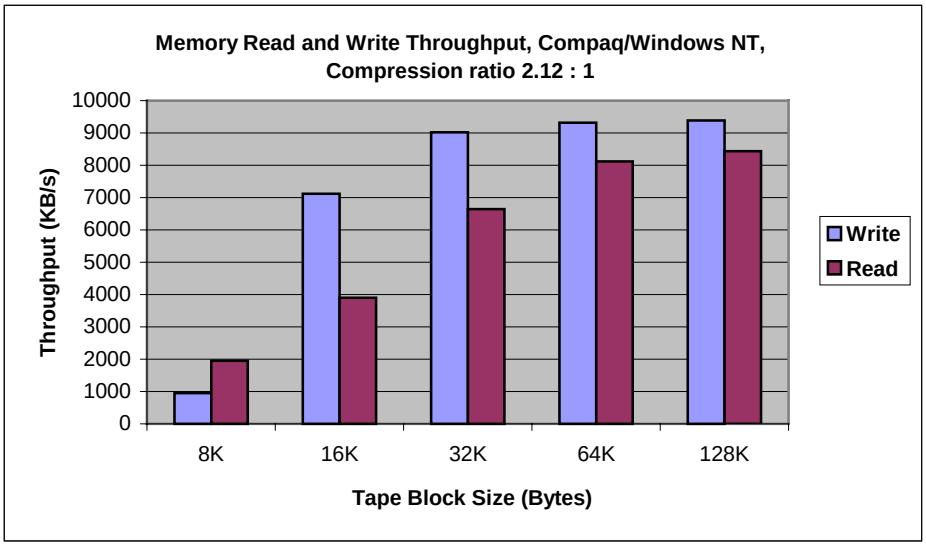
	Write	Read
8k	4444	1904
16k	5005	2962
32k	5079	4848
64k	5000	4846
128k	5080	4960



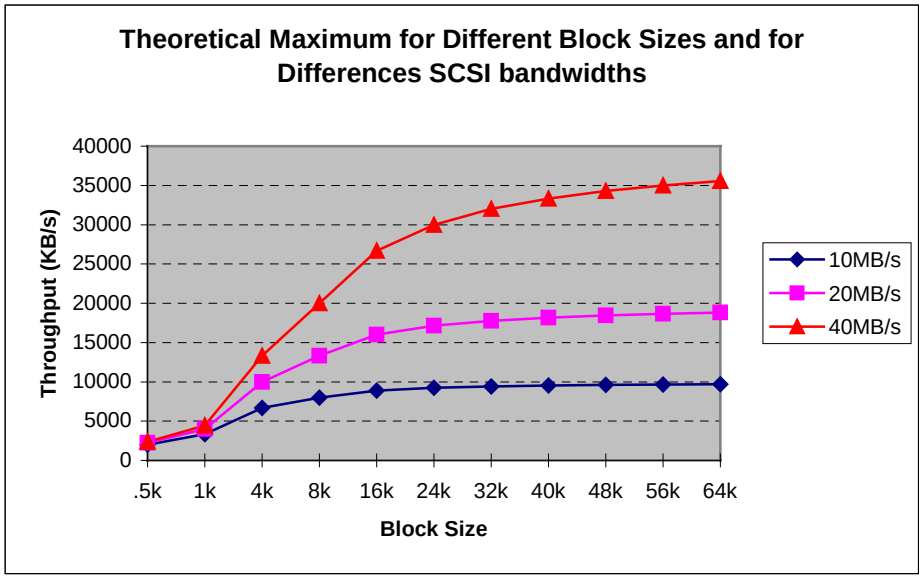
	Memory	
	Write	Read
8K	4818	1998
16K	4965	2978
32K	5120	5041
64K	5160	5120
128K	5140	5100



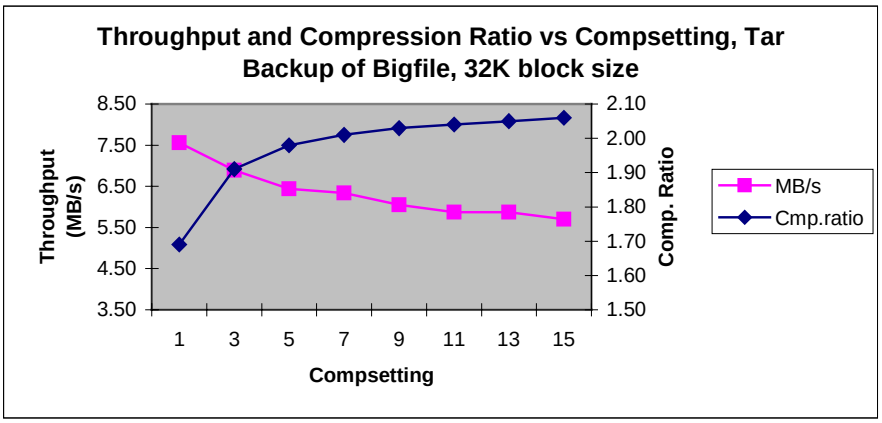
	Memory	
	Write	Read
8K	952	1951
16K	7123	3901
32K	9020	6642
64K	9318	8122
128K	9385	8438



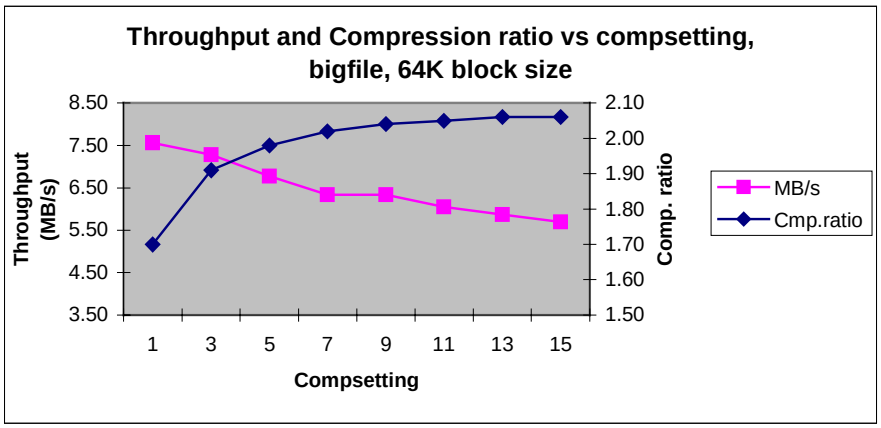
	Single 10MB/s	Wide 20MB/s	Ultra 40MB/s
.5k	2000	2222	2353
1k	3333	4000	4444
4k	6667	10000	13333
8k	8000	13333	20000
16k	8889	16000	26667
24k	9231	17143	30000
32k	9412	17778	32000
40k	9524	18182	33333
48k	9600	18462	34286
56k	9655	18667	35000
64k	9697	18824	35556



	MB/s	Cmp.ratio
1	7.56	1.69
3	6.89	1.91
5	6.44	1.98
7	6.34	2.01
9	6.05	2.03
11	5.87	2.04
13	5.87	2.05
15	5.70	2.06



	MB/s	Cmp.ratio
1	7.56	1.70
3	7.28	1.91
5	6.78	1.98
7	6.34	2.02
9	6.34	2.04
11	6.05	2.05
13	5.87	2.06
15	5.70	2.06



Some Guidelines

- **Use Variable Block Mode**
- **Use Big Block Sizes preferably 64k or higher**
- **Understand the bottlenecks in System and eliminate any bottlenecks in system**
- **DLT7000 has been optimized for higher throughput, not higher compression ratio. So, expect some capacity loss especially with 4meg cache.**
- **If your disk system cannot supply more than 3 MB/s, buy DLT4000 or DLT2000XT.**

DLT7000 has been optimized for higher throughput, not for higher compression ratio.

Future Products

Future DLTs will use four new Technologies:

Pivoting Optical Servo (POS):

- A Quantum invented optically assisted servo system.
- will provide low sensitivity to outside influences, deliver rugged, faster, substantially higher-capacity products with increased efficiency and data reliability.
- eliminate the need for tape to be preformatted, which decreases cost and increases user convenience.

Advanced Metal Powder (AMP) Media:

- state-of-the-art media using durable metal powder technology for storing very high densities of data and containing embedded information for the Pivoting Optical Servo system.

Magneto Resistive Cluster (MRC) Heads:

- cluster of small, cost-effective magneto resistive tape heads that can deliver higher data-transfer rates and capacity than traditional MR heads of equal size.

Enhanced Partial Response (EPR) Channel:

- advanced Partial Response Maximum Likelihood (PRML) channel co-developed by Quantum and Lucent/Bell Labs to bring new levels of performance and capacity to linear tape products.

Capacity and Throughput

Capacity

- Length of tape
- Number of tracks
- Bit density

Throughput

- Tape speed
- Bit density
- Number of tracks written

G = 12L*N*D/1.3

Where G is user perceived capacity in kilobytes
L is length of tape in feet
N is number of tracks
D is density in kilobytes/in
And 30 percent overhead.

$\mu = S*n*D/1.3$

where S is speed of tape in inches/sec.
n is number of tracks written
D is density per inch in kilobytes
And μ is drive transfer rate in kilobytes/sec.

Assume 3000' tape length, 1500 tracks/inch and 200000 bits/in

G = 12*3000*750*200000/(8*10**9*1.3)
= 519 GB

μ = 160*12*200000/(8*1.3*10**6)

= 37 MB/s