

Convergence of Emerging and Evolving Technologies

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Presented at the THIC Meeting at the

DoubleTree Hotel

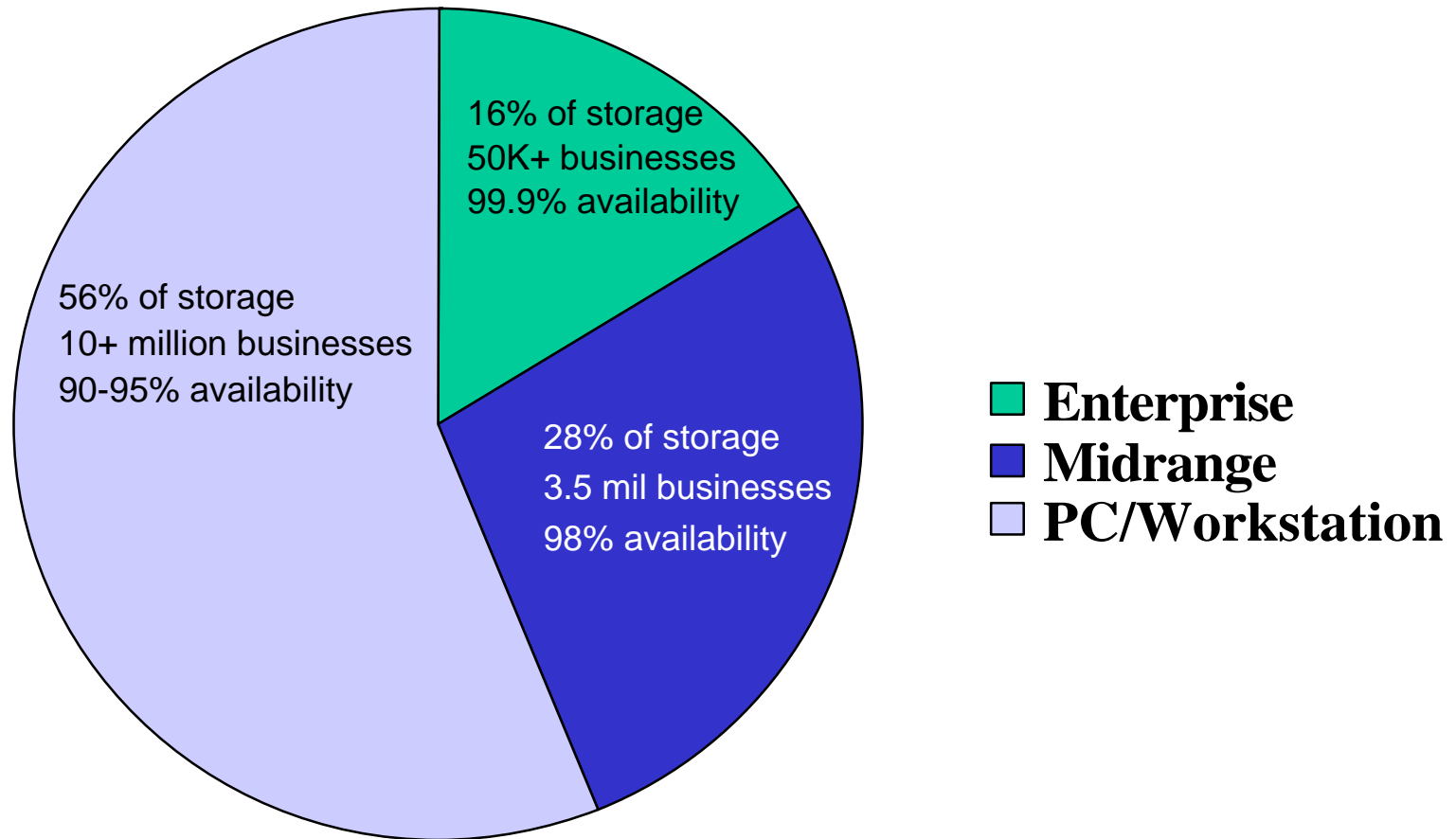
Del Mar CA 92130-2539

on January 18, 2000

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The Premier Advanced Recording Technology Forum

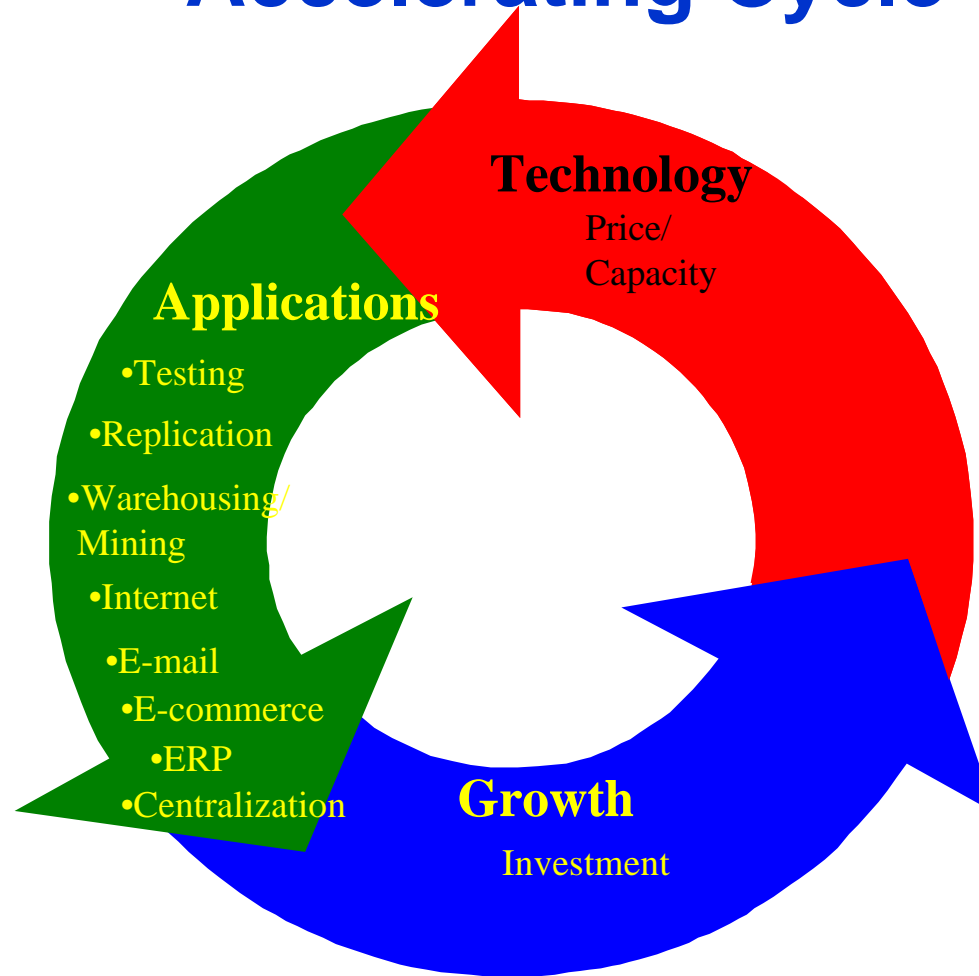
Capacity Distribution



Source: Fred Moore, *Storage Panorama 2000*, p.2

Growth

Accelerating Cycle



Unprecedented Market Growth

- Average capacity growth exceeds 60% per year
 - NT, Dot Coms, ISPs and ASPs growth >100%
- Revenue will increase at 16% per year to \$42 BB by 2002

Cost of Storage is Not an Issue (for awhile)

- This year disk storage will be 10-20¢ per megabyte in a subsystem, < 5¢ /MB at the work station level
 - 3½ inch 9-36GB capacity products now shipping are at 2.2Gb/in²
 - 35Gb/in² demonstrated in IBM Almaden Lab in October 99
 - 522Kbpi X 67.3K TPI with uncorrected error rate <1 in 100 million
 - 73GB capacity announced in October 99 (7Gbits/ in²), avail this quarter
- Magnetic tape storage will be 0.5¢ per megabyte (2000)
 - At 6Gb/in², it will exceed optical by year-end 2007
 - 4-15 X the data on magnetic disk due mainly to replicate copies
 - beginning to see a trend toward magnetic disk for back up

IT Managers Top Requirements (a non-exhaustive generic list)

- Availability
- Performance
- Storage Management

Focus on Availability

	Unavailability (minutes per year)	System Availability (% uptime)	Availability Class
Unmanaged	50,000	90.0%	1
Managed	5,000	99%	2
Well Managed	500	99.9%	3
Fault-Tolerant	50	99.99%	4
High Availability	5	99.999%	5
Very High Availability	0.5	99.9999%	6
Ultra-Availability	0.05	99.99999%	7

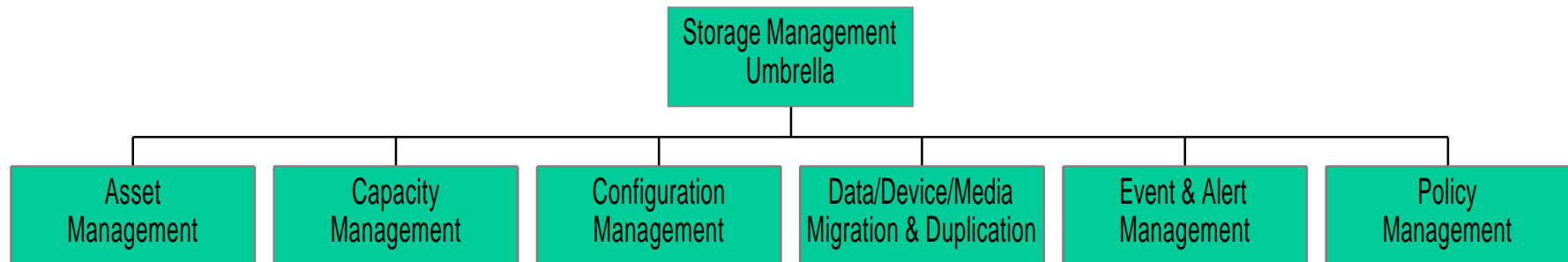
Source: Fred Moore, *Storage Panorama 2000*, pp. 4

Performance Improvements

Media	Innovation	Description
Mag Disk	Access Density Rotational Delay Op Sys Affinity*	Caching, Parallelism, Access Ordering Greater RPM: 5.4K; 7.2K; 10.0K; 12.2K PAV, Multiple Allegiance, Priority Queueing
Opt Disk	Two sided recording	Up to 2 X Data with a single actuator movement
Enterprise Mag Tape (ex. DLT, Hel Scan, Travan and 1/4 in. devices)	Mid position cartridge (12 sec initial load) Virtual Tape Subsystems	Halve search time Vs. front-end loading cartridges; eg. StorageTek's 9840 (Eagle), IBM's 3590E, LTO Consortium's Accelis Outboard HSM; IBM's VTS; STK's VSM; Sutmyn's VTS

* Minimize I/O queuing at the device level. IBM ESS only at the present time - EMC and Hitachi are thought to be developing similar function

Storage Management



- In the main being addressed as a part of SAN deployment
- Must be interoperable across all storage vendors
- Must be controlled from one point (across the I-net)

- Asset Management
 - What is out there (Discovery)?
 - type, model, serial number, features
 - Where is it located (Discovery)?
 - To what is it connected (Topography)?
 - Who is using it?
 - When was it acquired?
 - How much did it cost?
 - Purchase or lease?
 - Lease expiration date
 - Maintenance information

- Capacity Management
 - How much is out there?
 - Volumes, LUNs
 - How much is being used?
 - What are the trends & patterns in usage?

- Configuration Management
 - View of configuration parameters
 - Host connectivity (adapters)
 - Primary & alternate pathing
 - Cache size
 - Devices
 - physical attributes
 - logical attributes
 - virtual attributes
 - Ability to dynamically change above configuration parameters
 - RAID characteristics

- Data/Device/Media Migration & Duplication
 - Migrate data and metadata to new technologies
 - Move data to another subsystem
 - Move data to another volume
 - Move data to another media
 - Duplicate data for testing
 - Duplicate data for backup
 - Duplicate data for recovery
 - Duplicate data for restart
 - Remote copy
 - distance limitations
 - performance impact
 - recovery or restart
 - integration into application procedures

- Event Management & Alerts
 - Establish thresholds?
 - Automate exception handlers?
 - Monitor errors & failures
 - Receive notification of exception conditions

- Policy Management Items to Consider
 - type of media
 - capacity allowed
 - performance requirements
 - availability requirements
 - migration alternatives
 - charge back scheme
 - backup requirements
 - documents
 - retention/deletion requirements
 - hold orders

Thank you!

A few minutes for Q & A