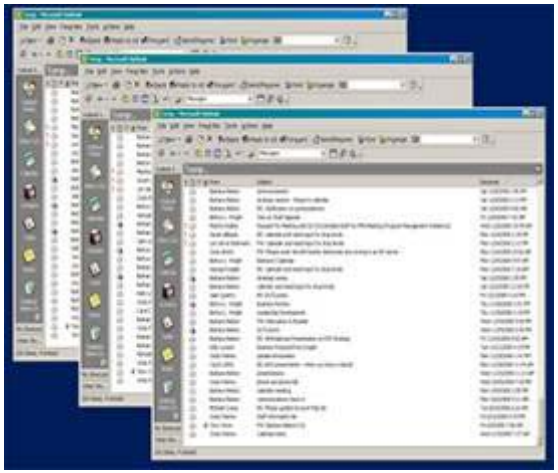
Backup and Restore Techniques

Shahzada Sufyan
Product Marketing Manager
Hewlett-Packard

Data Storage is Mission-Critical

Data is continuously growing



Storage for e-mail growing at 300%/year

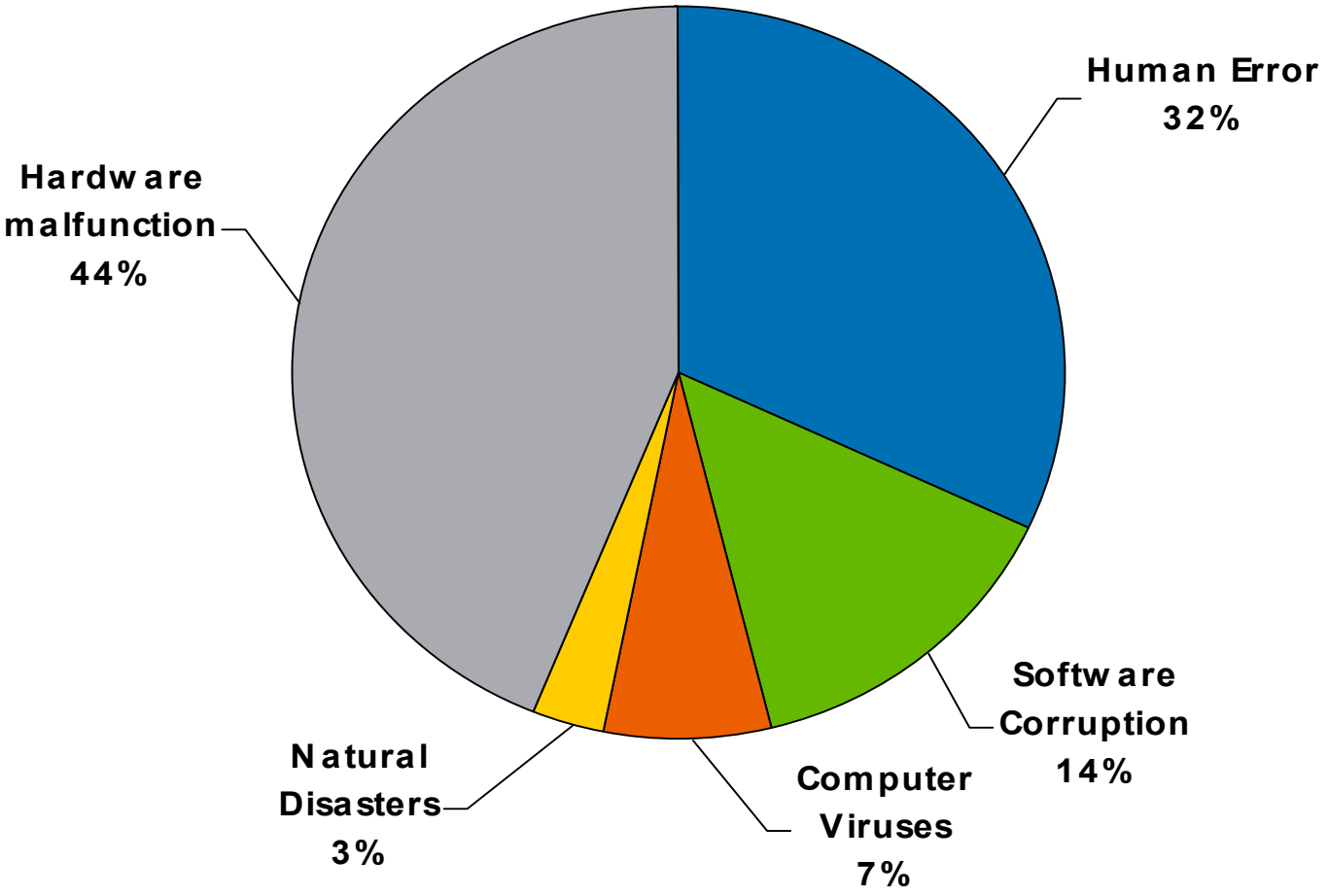
Data access is invaluable

Direct cost of downtime for brokerage is $6.5 million/hour

Data is more susceptible

Power outage, human error, virus, theft, natural disaster, terrorist attack

Common causes of data loss



Source: Ontrack Survey 2002

Compliance with government regulations – even more demands on data storage

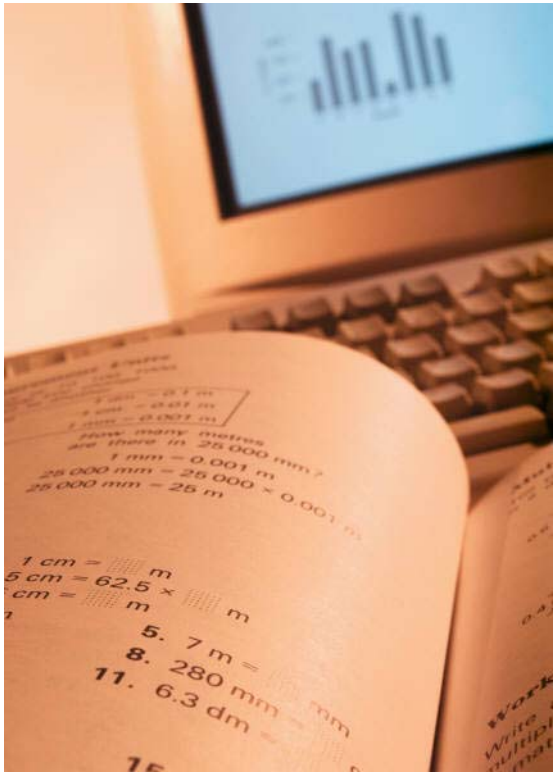
Recent legislation:

- Sarbanes-Oxley Act 2002
  - To deter and punish corporate and accounting fraud
- European Union Data Protection Directive 2002
  - Ensuring protection and privacy of personal data
- USA Patriot Act 2001
  - Increased surveillance and investigative powers of the law enforcement agencies to search through computer records
- Gramm-Leach-Bliley Act 1999
  - Protects consumers personal financial information
- Health Insurance Portability and Accountability Act 1996
  - Protects patient records privacy and security

Organizations worldwide are required by law to store, manage and safeguard more of their data than ever before

Backups are complex !

- Multiple choices for hardware, software, technology, interface, topology
- Complex backup processes
- Complex device management
- Systems disruptions
- Multiple data retention options

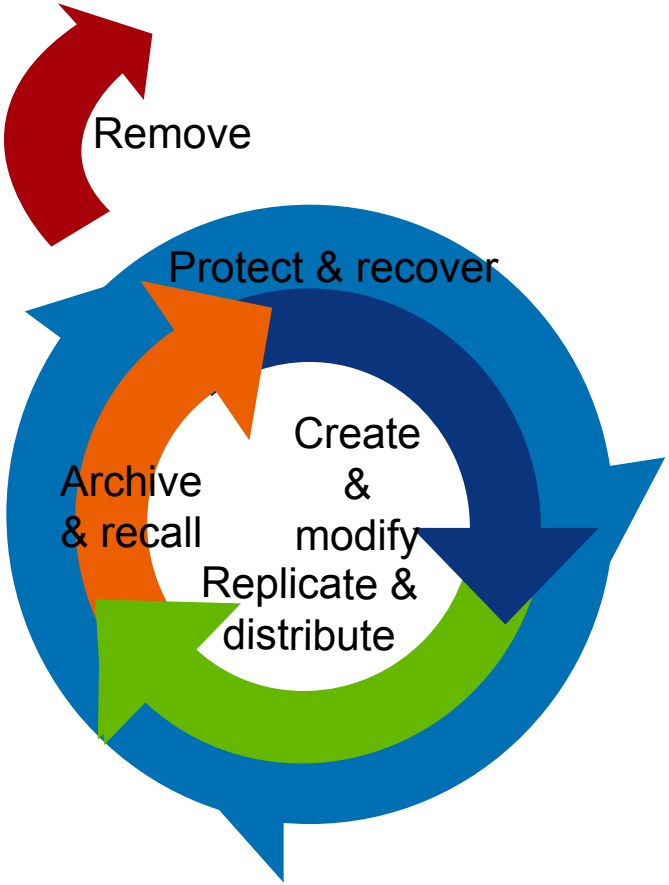


ESG reports that"… still today the #1 issue plaguing IT managers is protection and recovery of their information"

Source: Enterprise Storage Group Reports, October 2003

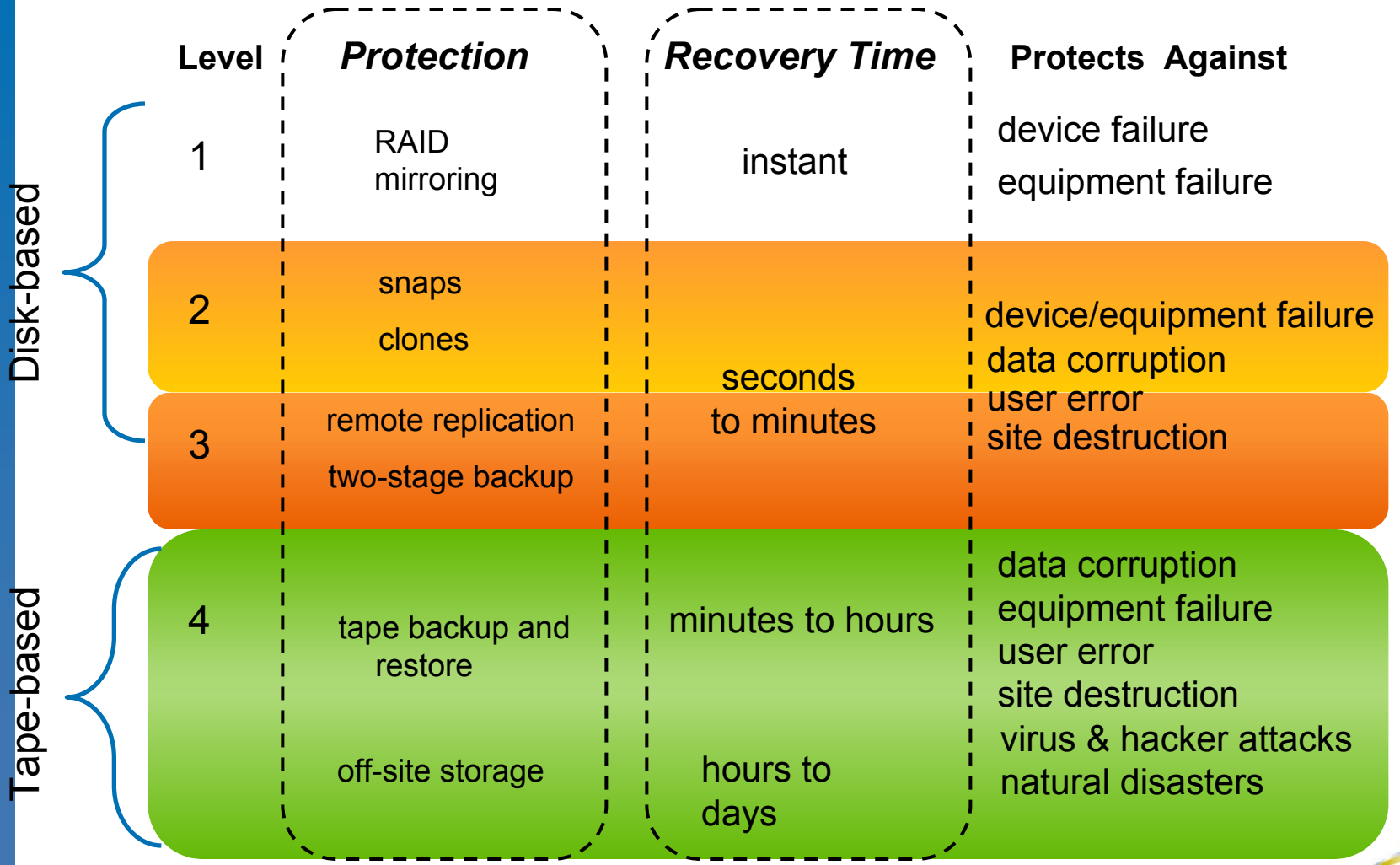
Multi Level Protection and Recovery

- Information protection and recovery takes place throughout the lifecycle of data with mirroring, replication, snaps, clones, disk and tape backup
- a multi-layered approach to data protection and recovery is a must



Information Lifecycle Management process flow

Multilevel Protection and Recovery Techniques

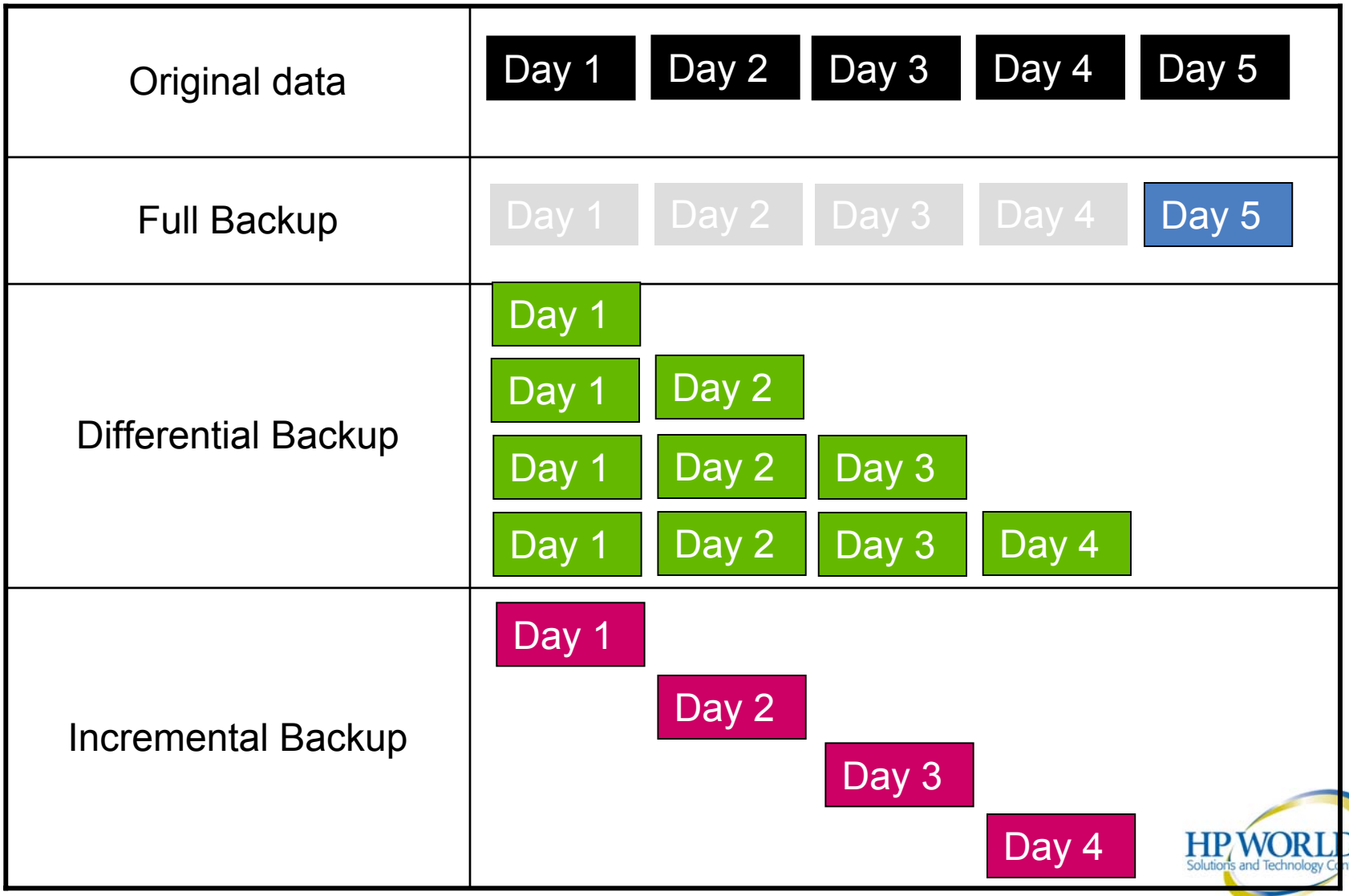


NOTE: Optical may also be used when single-file access speed *and* removability are required

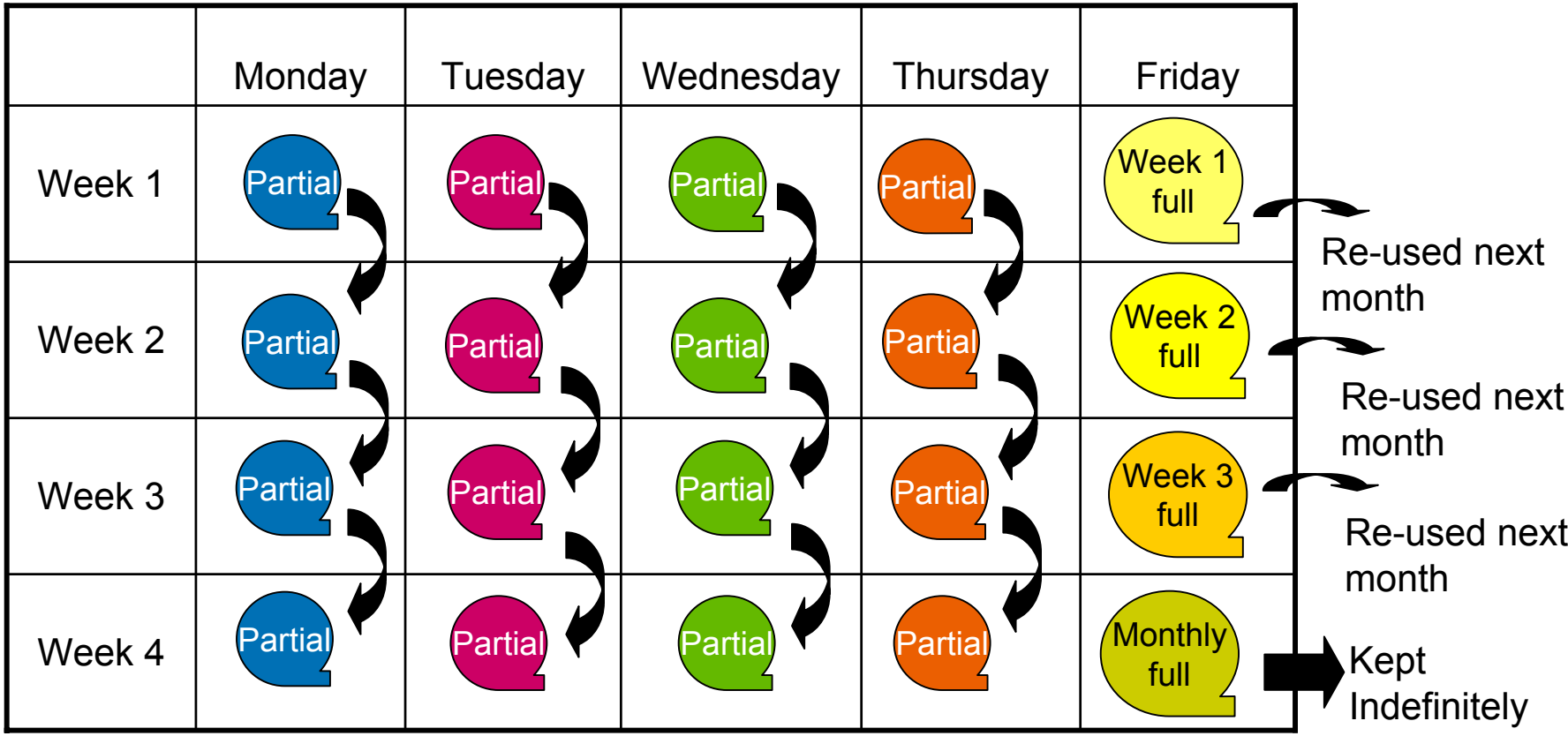
Considerations when implementing a tape backup strategy

- Determine system backup requirements: which systems are critical for backup, which parts can be backed up less frequently?
- Determine data capacity and backup window requirements AND expected growth in next 2-4 years
- Select the right tape backup technology
  - LTO, SDLT or DAT (Is backward compatibility important?)
- Type of backup device: tape drives or automated tape libraries
- SAN or LAN based backup ?
- Select the right backup software
- Plan the backup : full, differential or incremental backups
- Ensure good housekeeping: rehearse disaster recovery procedures, etc.

Planning the backup: Full, differential, or incremental?

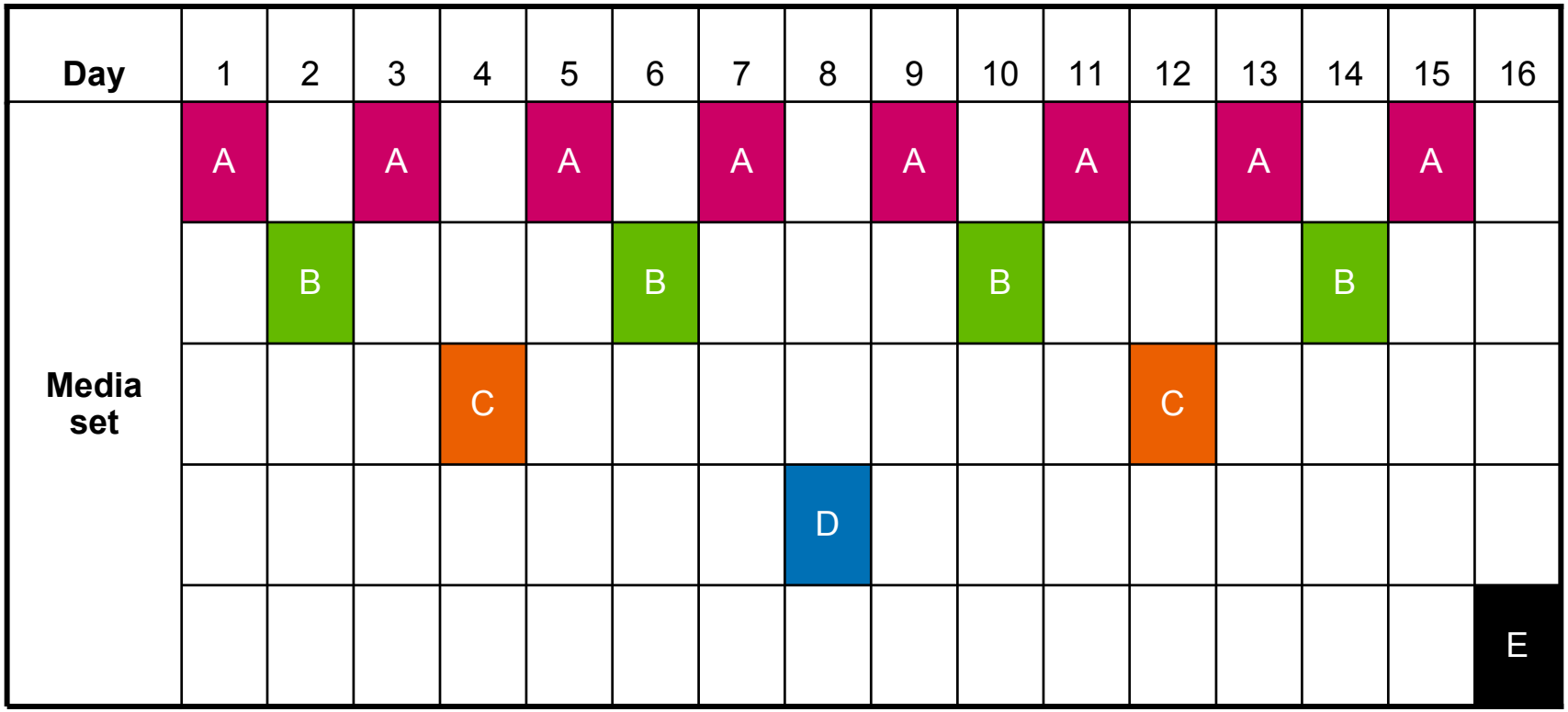


Media rotation schemes: Grandfather-father-son



- Monday-Thursday tapes re-used weekly
- Fridays 1-3 tape re-used monthly
- Friday 4 tape kept indefinitely

Media rotation schemes: Tower of Hanoi



- Set “A” starts on day one and repeats every other day.
- Set “B” starts on day 2 and repeats every fourth day.
- Set “C” starts on day 4 and repeats every eighth day.
- Set “D” starts on day 8 and repeats every sixteenth day, etc.

Return to day 1

Media rotation schemes: Media X method

10x scheme	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	1	2	3	4	5,6,7,8
Week 2	2	3	4	5	6,7,8,9
Week 3	3	4	5	6	7,8,9,10
Week 4	4	5	6	7	8,9,10,1
Etc…					
Week 7	7	8	9	10	1,2,3,4
Week10	10	1	2	3	4,5,6,7

Repeat from Week 1

- Numbered tapes that move up one space each week

Good housekeeping is essential

- Document all procedures
- Purchase high-quality media
- Regularly clean and maintain the tape drive
- Store media securely onsite and offsite
- Rehearse data recovery and disaster recovery procedures
- Regularly test data recovery on sample system

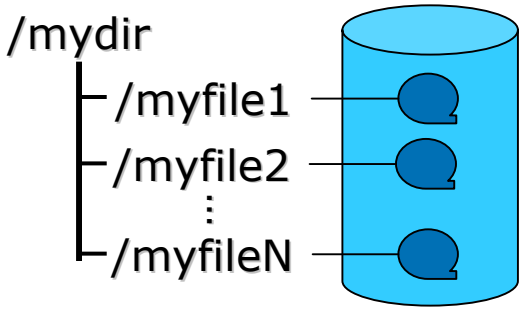
Disk-assisted backup solutions available today

- Virtual tape
  - tape emulation
  - simple backup to files on disk
  - staged backup to disk then tape
- Snapshots and clones
  - maintaining point-in-time copies or full image copies on disk
  - Off host backup from split disk mirrors to tape
- Content Addressed Storage
  - continuous incremental backups forever
  - virtual full image restore

Virtual Tape

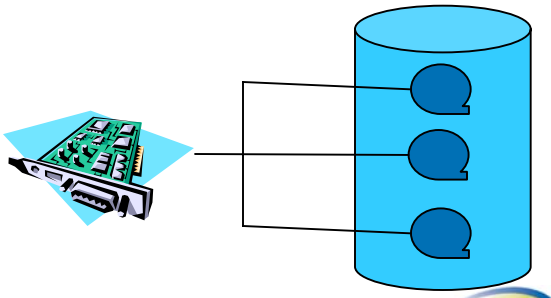
Software

- backup is written to a file by backup application
- backup can be subsequently migrated to tape
- format on disk is the same as on tape
- restore can be from disk or tape and must be managed by backup application

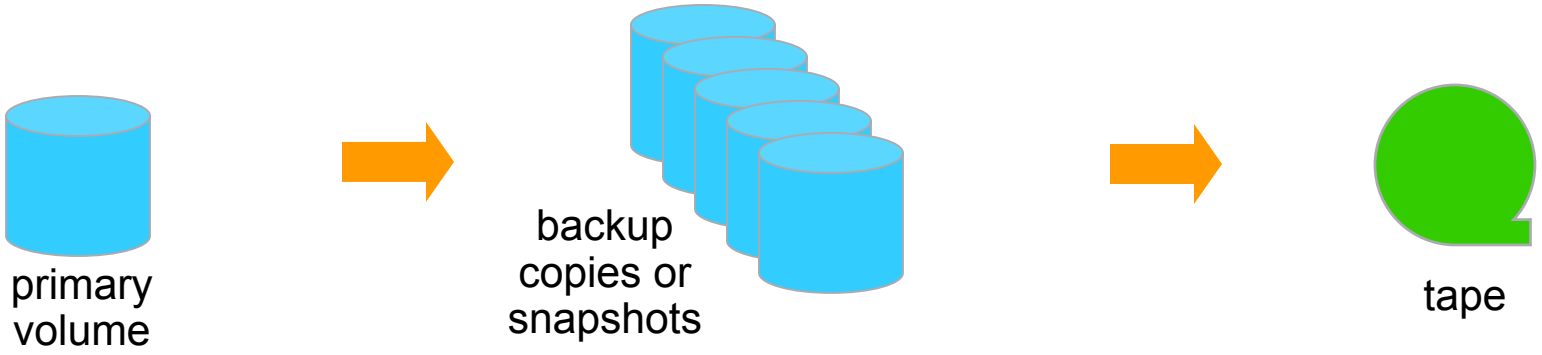


Hardware

- a controller presents disk storage as a set of scsi tape devices to hosts
- data can be migrated to tape either transparently, or through control of the backup application



Snapshots, Mirrors and Clones



- Multiple copies or snapshots are kept on disk for fast recovery through the OS file system structure
- Copies can be migrated to tape for long-term retention via a backup application

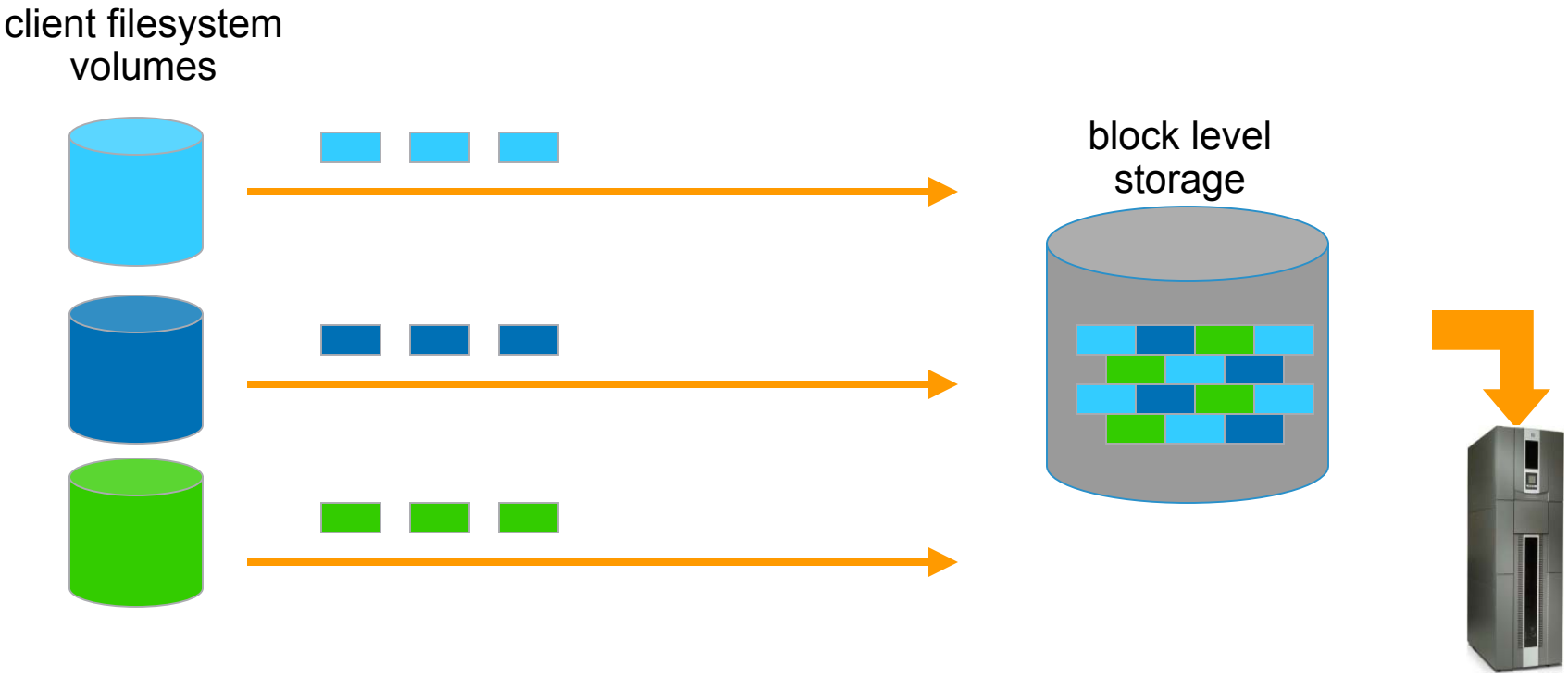
Hardware

- Utilizing disk array controller, within the same frame or using remote mirrored copies between homogeneous disk arrays

Software

- Implemented within the I/O stack on the host or in the SAN allowing the use of different disk array types including low-cost disk

Continuous block-level backup



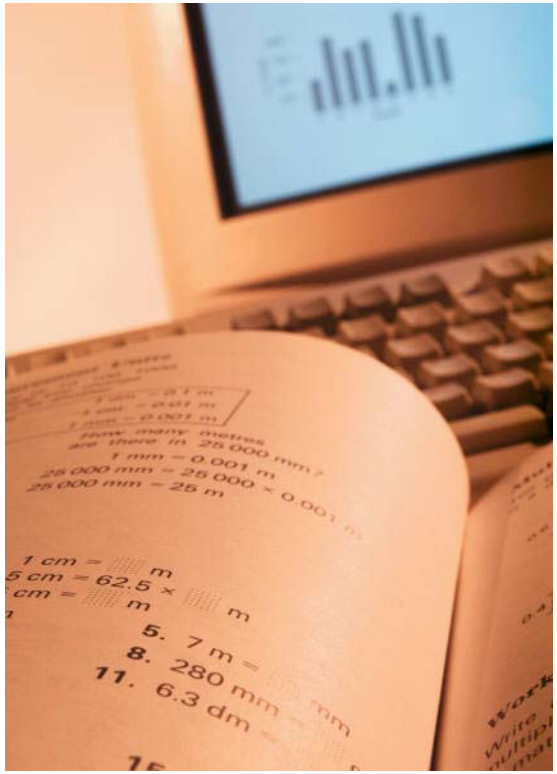
- Only changes are sent and stored.
- Virtual full restore image can be by created by assembling correct blocks, and archived to tape for vaulting and fast image restore.
- Redundant blocks are stored only once reducing storage requirements.

Considerations when selecting disk-assisted backup solutions

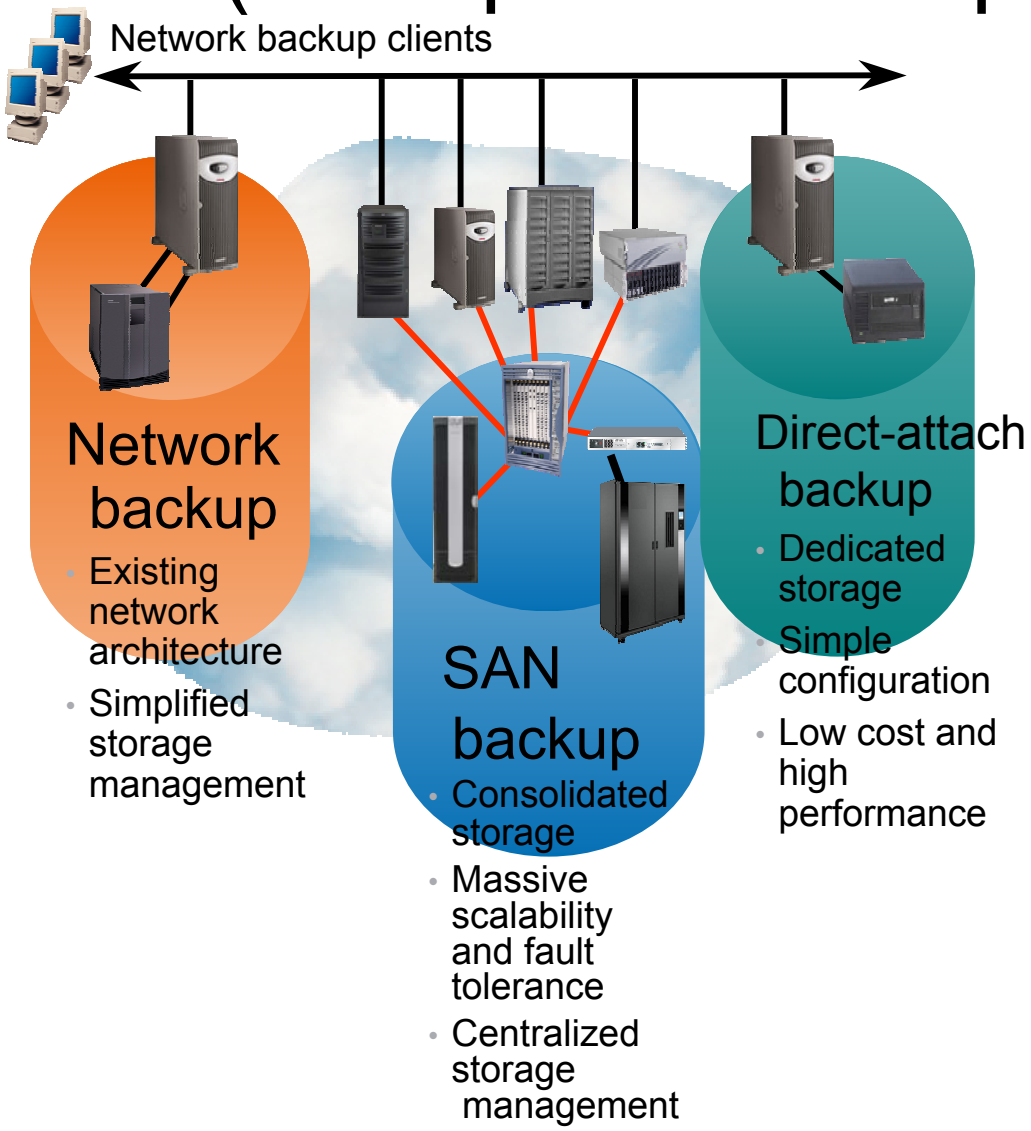
- Effectiveness of Data Protection
  - Data Format
  - Ease of site protection
  - Protection against malicious attack
- Price of Disk vs. Tape
  - Economics of Data Retention
  - Data Density (Compression)
- Performance of Disk vs. Tape
  - Volume Restore vs. File Restore
  - Volume Backup vs. File Backup

Backups are Complex

- What is HP doing to simplify backup and restore



EBS (Enterprise backup Solution)



- End to end **documented** data protection solution
- Fully tested, certified and supported configurations by HP
- Scalable solutions from an autoloader to an enterprise class tape library
- Simplify SAN configurations for backup
- EBS Business & Technical Blue Prints for easy sales information
- EBS design guide for quick and easy configuration

For information on HP EBS solutions go to
www.hp.com/go/ebs

Simplification of backup config design

- The 1st step in implementing an EBS solution - consult the **EBS Compatibility Matrix** for compatibility information
  - (go to www.hp.com/go/ebs and select EBS Compatibility matrix)
- This **EBS design guide** is the 2nd step. This guide describes the EBS hardware configurations currently supported and how to efficiently and effectively provide shared tape library backup in a heterogeneous SAN environment
  - (go to www.hp.com/go/ebs and select technical documentation)
- The third step – Implementing Backup Solution is installing and configuring your backup application or backup software. Rules and recommendations for individual backup applications and software may be found in separate **Implementation guides**
  - (go to www.hp.com/go/ebs and select technical documentation)

HP Backup Sizer

- **HP Backup Sizer**
  - HP StorageWorks Backup sizing tool is a Windows-based tool that allows the users to size and configure the ideal backup solution using specified information
  - Can configure a tape solution with certified ISV backup applications
  - Provides solutions for SAN and DAS tape environments
  - **Free of charge!**

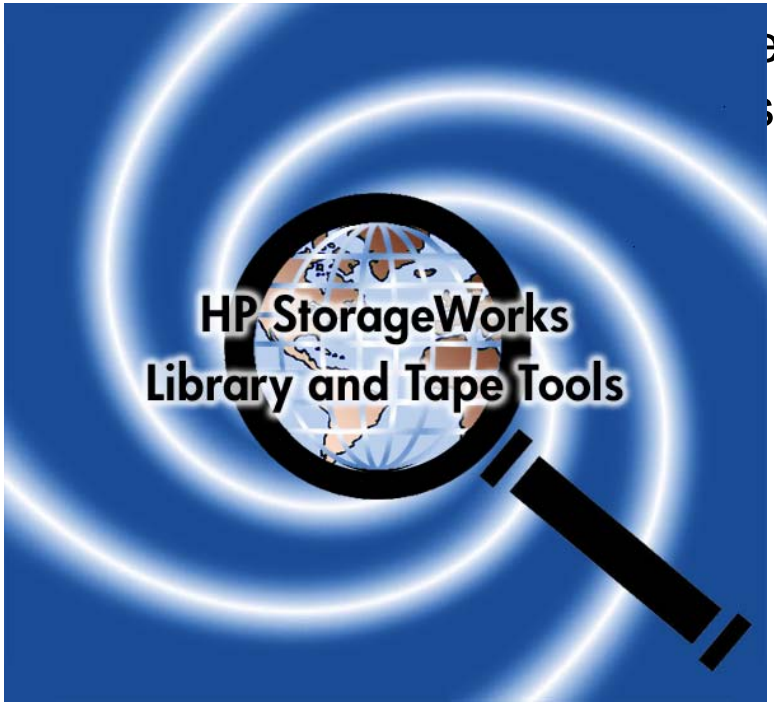
www.hp.com/go/swbst

HP StorageWorks Library and Tape Tools

Common diagnostic tool for all HP tape drives, tape libraries and optical jukeboxes

Diagnose and fix problems easily and quickly

- Free download plus quick installation
- Intuitive user interface requires no training
- Web-based firmware downloads, updates and notifications
- Support ticket generation
- Performance-measurement tools
- Supported on multiple operating systems

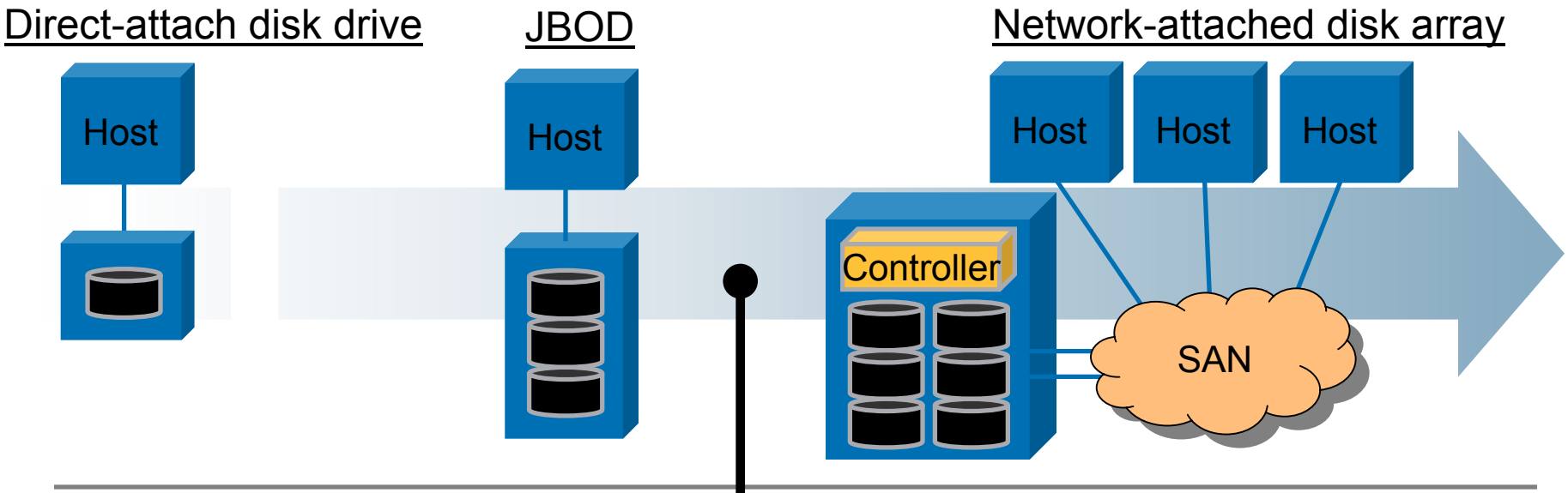


www.hp.com/support/tapetools

A new architecture!

Features of the Extended Tape Library Architecture

Evolution of disk network storage



Attributes of well-designed network storage:

- Consolidated
- Secure
- Scalable
- Shareable
- Reliable
- Manageable

Today's tape libraries

- Native-FC tape libraries provide JBOD equivalent capability
- Additional capability available with router-based tape libraries
- Need more security, reliability, shareability and manageability

Missing from SAN backup

- Backup sensitivity to SAN interruptions
- Troubleshooting and diagnostic support
- Security in library
- Multiple-library management – one tool
- Easier management (hide complexity)
- Path redundancy (+ load balancing)
- Drive hot-sparing
- Partitioning
- Performance analysis

The hp strategy for network storage tape libraries

"HP StorageWorks Extended Tape Library Architecture"

To meet demanding enterprise requirements, HP has introduced a new tape library architecture designed specifically for the SAN.

This new architecture addresses the high reliability and interoperability needs for enterprise SAN environments by adding intelligence and advanced capability into tape storage systems.

Extended Tape Library Architecture

Library Management for the ESL libraries is part of the Extended Tape Library Architecture

Interface Controllers

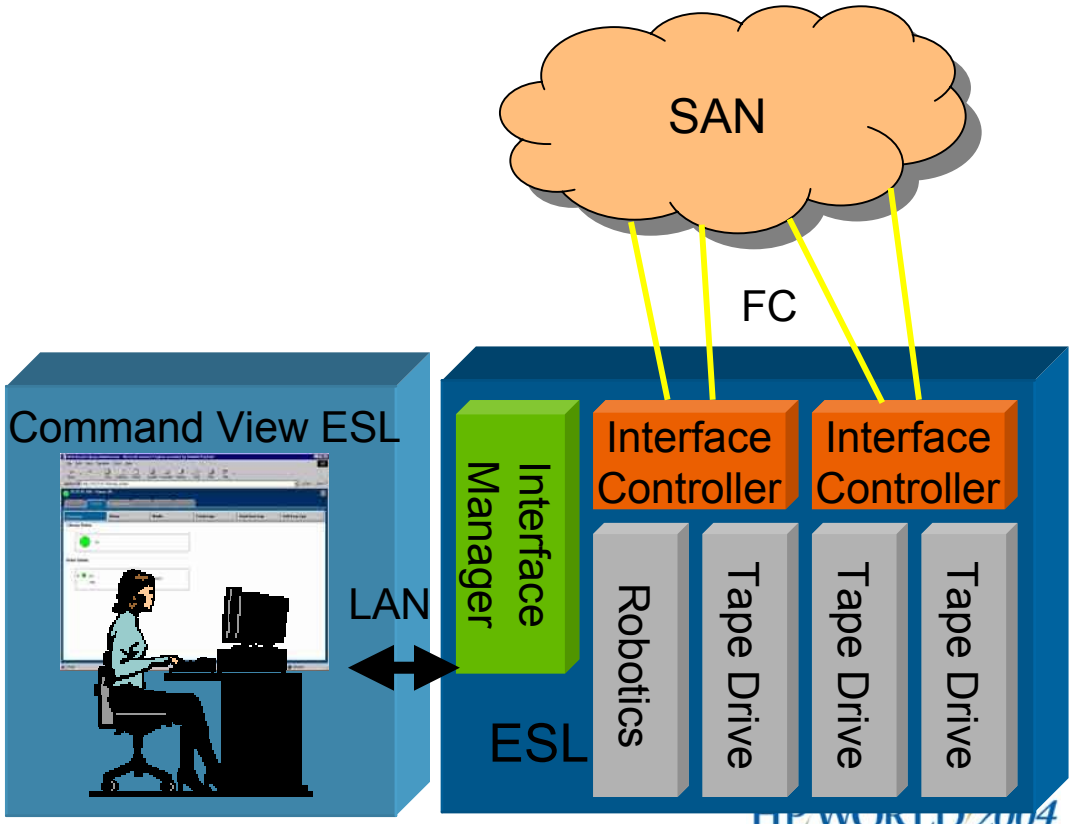
Control the data path between the hosts and drives/robotic of the library

Interface Manager

Management interface of the library

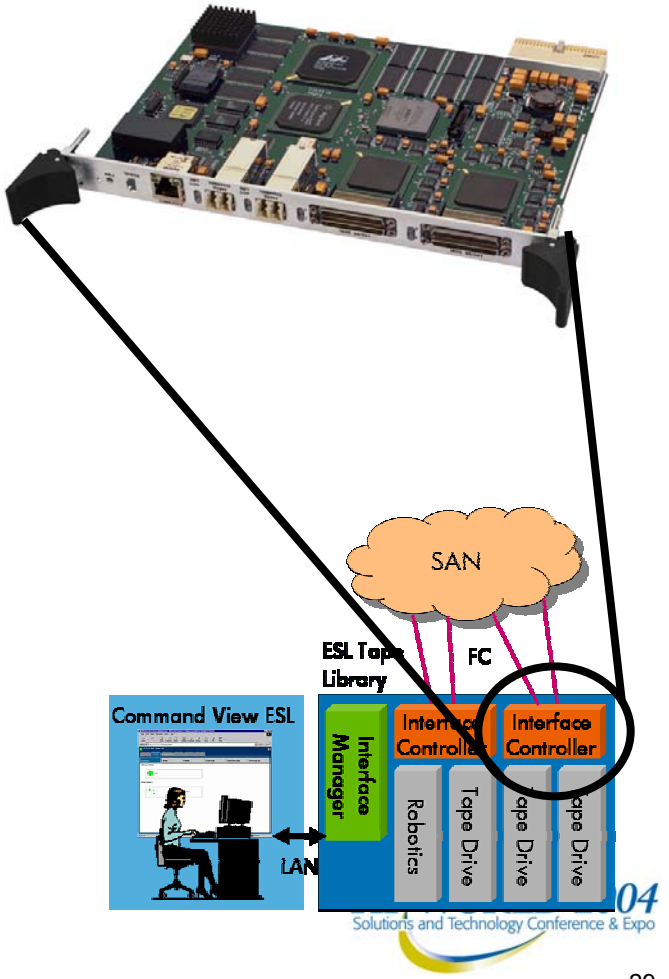
Command View ESL

Software to communicate with the interface manager



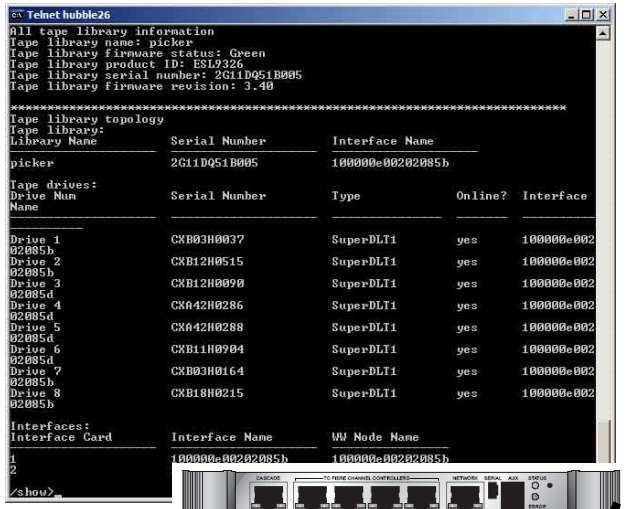
Interface Controller

- Layer of intelligence between tape drives and the SAN
- Manages shared access to the tape library
- Intelligently handling conflicts and storage network events
- Platform for added values of the Extended Tape Library Architecture
- Configured and managed through the interface manager
- Available as FC-to-FC or FC-to-SCSI version



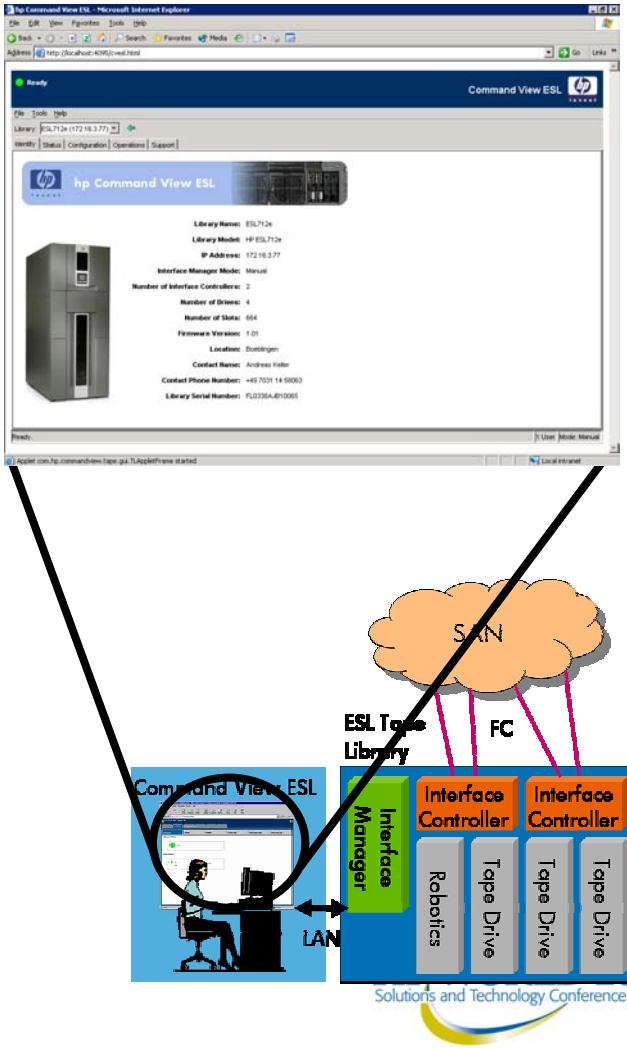
Interface Manager

- A central point of knowledge for the entire tape library subsystem:
- Enables remote management
- Provides a command line interface accessible via telnet and ftp
- Central point for firmware upgrades to all library components
- Enhanced troubleshooting and event logging in combination with HP's Library & Tape Tools

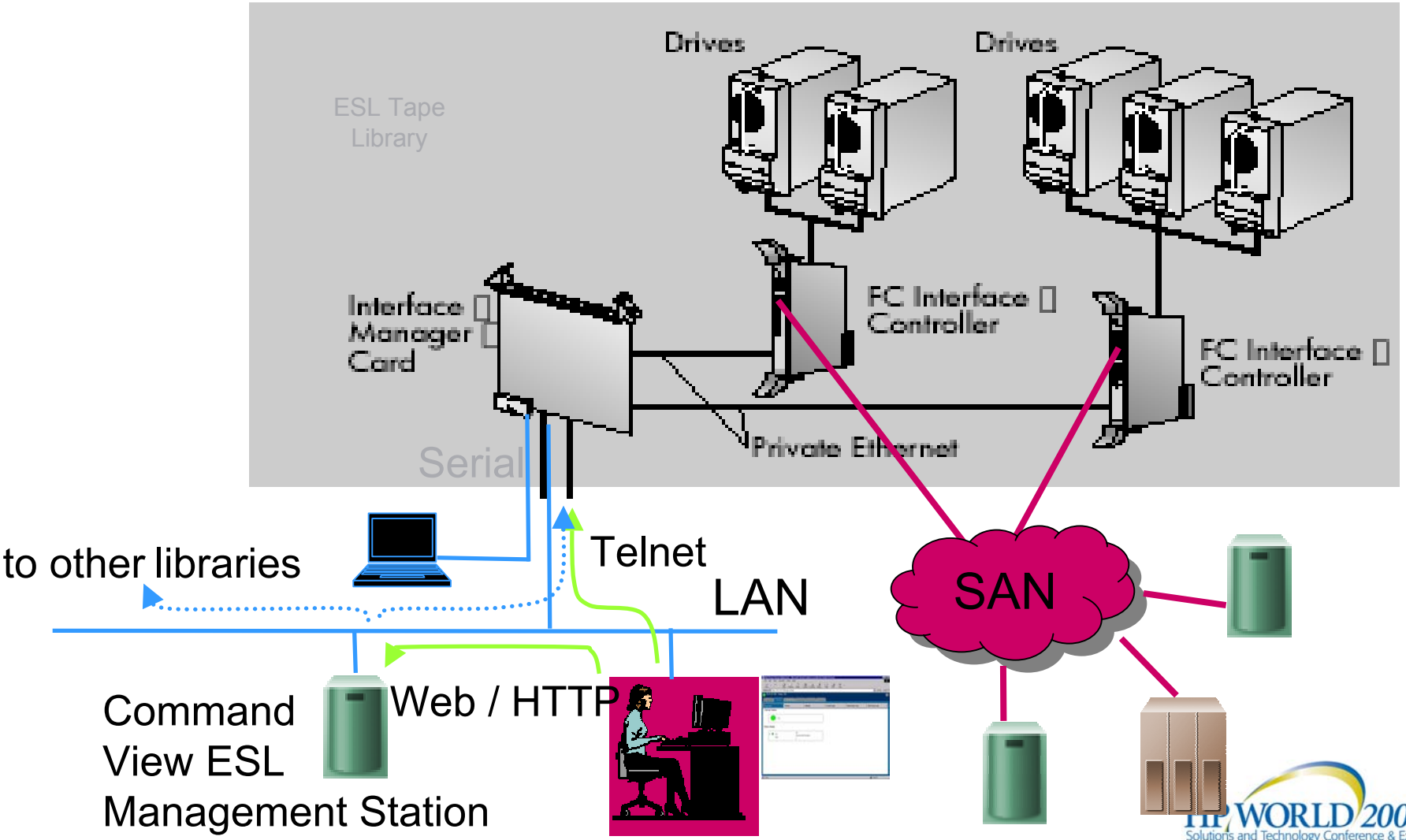


Command View ESL

- A single pane of glass view of the entire library
- Delivers easy-to-use remote management
- Simplifies and automates the most complex tasks
- Stays *out* of the SAN to allow critical traffic to flow
- Management of several libraries with one management station

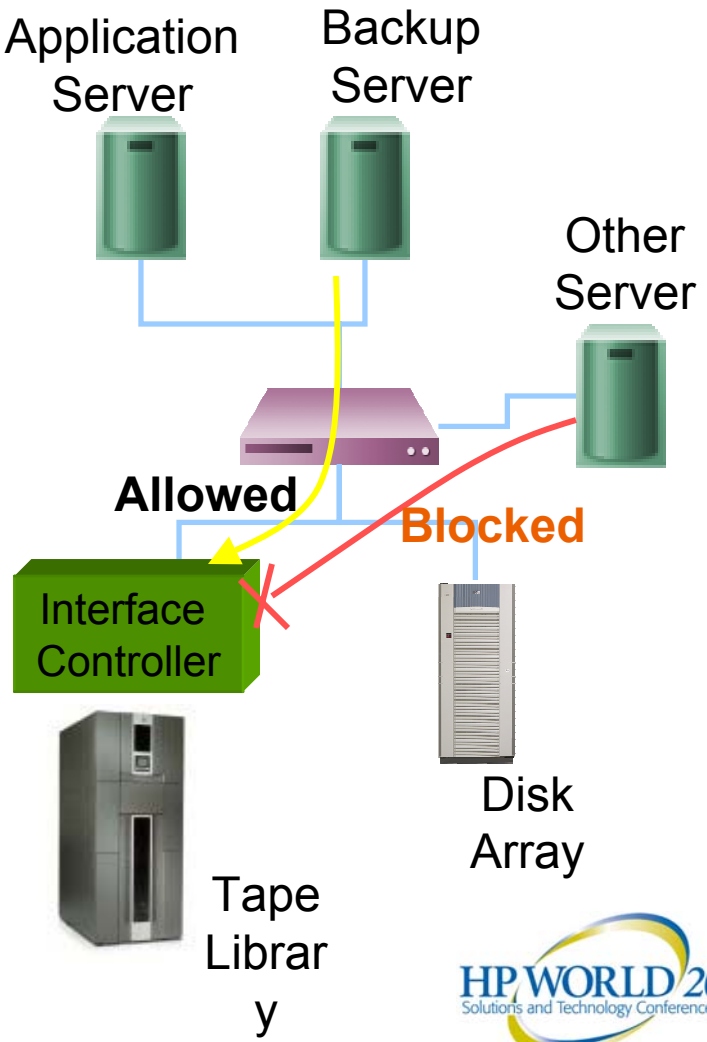


The Big Picture: Topology and Interfaces



Advanced Access Control with Secure Manager ESL

- Manages access from HBAs to individual tape drives / robotic
- Security is enforced by interface controllers
- Only necessary servers get access to tape drives in order to improve robustness of SAN backup
- Configurable through Command View ESL or CLI



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Questions ?

Backup Section

Abstract

- **Backup and Restore techniques**
- **Abstract**: Data Protection and restore strategy is a must for any business continuity plan. What is the right Data Protection Strategy for your environment? During this session, we'll take a look at multi-level data protection and data recovery scenarios, and HP's extended architecture for intelligence in backup and restore platforms.
- .
- **Benefit #1**: Multilevel data protection and recovery provides the best techniques for protecting valuable data
- **Benefit #2**: Utilizing a mix of technologies provides the best data protection
- **Benefit #3**: HP's extended tape library architecture introduces intelligence in the backup and restores solutions for ease of management and configuration

Impact to business operation

Obvious impact	Behind the scenes
No Internet	No payroll
No email	No accounting systems or finance information available
No printing	No access to client data (CRM)
No company website	No order entry
No e-commerce capability	No access to files – drawings, reports, and more
	No telephone (VOIP)

What's data worth?

- The financial impact of losing data is a combination of
  - Loss of business
  - Loss of productivity
  - Legal action
  - The cost of re-creating data

Cost of re-creating 20MB of data

Data type	Time to re-create 20MB	Estimated cost
Sales & Marketing	19 days	$17,000
Accounting	21 days	$19,000
Engineering	42 days	$98,000

Source: Ontrack 2002

What's your data worth?

Possibly your entire business…

80% of companies without well-conceived data protection and recovery strategies go out of business within 2 years of a major disaster

Source: US National Archives and Records Administration 2002

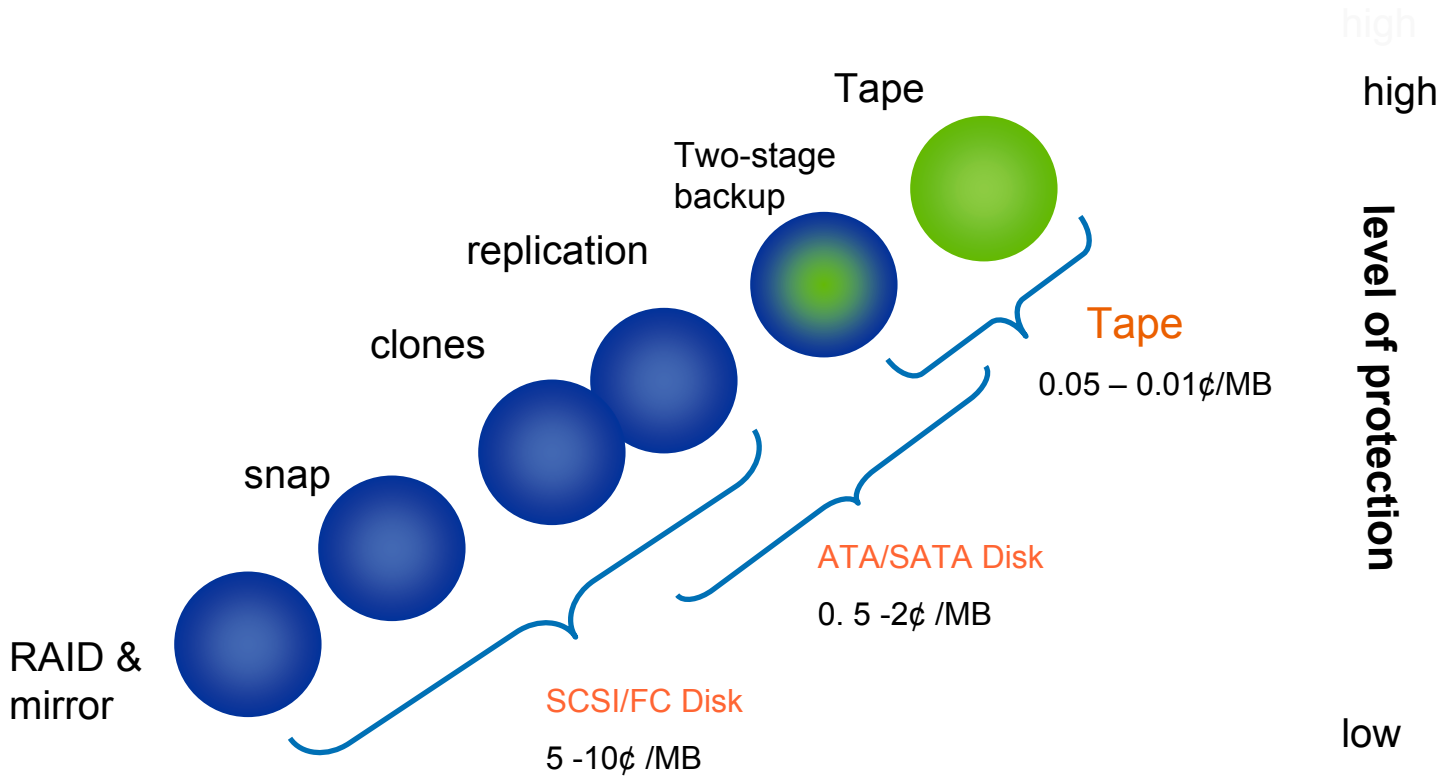
Multilevel Protection and Recovery

- Integrates tape, disk, software and services to provide the complete solution.
  - simplifies the process of choosing and managing the appropriate protection and recovery strategy
  - It encompasses disk, tape technologies, media and software for short and long-term protection such as optical
  - Provides flexibility for ultimate protection and fastest recovery to reduce management costs
  - It serves Direct attach, SAN and NAS environments
  - With HP OpenView software, managing these solutions becomes easy

Backup Considerations

- Data is your company's most valuable asset
- Get you data safe
- Get you data safe while not impacting production
- Get your data safe as fast as possible

Protection and recovery technologies



Selecting backup software

- HP tape drives come complete with backup software in the box
- If more sophisticated software is required, consider whether you need:
  - Centralized administration of multiple servers
  - Intuitive application interface
  - Disaster recovery capabilities
  - Scalability for future hardware additions
  - Ability to back up files even when they are open
  - Compatibility and support with your selected tape drive

Disk-assisted backup solutions Comparison

		Advantages	Disadvantages	Use Models
Virtual Tape	SW	• No media loading/positioning • Fast single file restore • Improved backup reliability	• Slower than tape for sequential full backup and restore operations	• Transaction log backup • Backup for slow clients • Staging to tape • Real-time single file restores due to user error
	HW	• Above plus… • Emulates legacy tape		• Above plus… • Legacy platform support
Snapshots, Mirrors & Clones	SW	• Zero impact HA backup • Instant full image recovery • Leverage high availability configurations	• Using low-cost disk will limit performance of mirror and use as redundant copy	• Database backup • High-availability backup • Real-time single file restores due to user error
	HW		• Requires use of expensive disk space	
Content Addressed Storage		• Incremental backups (faster) • Fast single file restore • Reduced storage requirements • No media loading/positioning • Improved backup reliability	• Slower than tape for sequential full backup and restore operations • Not as good for rapidly changing data • Not suitable for databases	• File server backup and archiving • Backup of large number of small files

HP Offerings for Disk-Assisted backup

		HP Solutions
Virtual Tape	SW	• HP OpenView Storage Data Protector
	HW	• Falconstar Virtual Tape
Snapshots, Mirrors & Clones	SW	– HP OpenView Storage Data Protector w/ Windows 2003 Volume Shadow Copy (VSS) – HP OpenView Storage Mirror
	HW	1. HP OpenView Storage Data Protector w/ Instant Recovery 2. HP Zero Down-time backup (ZDB) 3. HP XP disk array with Business Copy 4. HP EVA with snapshot
Content Addressed Storage		• HP OpenView Storage Data Protector Intelligent backup to disk (future – 5.5)

Common myths on Disk and Tape

- Disk is always faster than tape
- Disk is more reliable than tape
- Disk is cheaper than tape
- Disk protects against technology changes
- Disk can replace tape

Extended Tape Library Architecture

- Products & solutions that are part of HP's Extended Tape Library Architecture are *created* for SANs
- The HP Extended Tape Library Architecture provides enterprise storage network customers superior reliability, interoperability and advanced functionality

Interface Controllers

- Layer of intelligence between tape drives and the SAN, similar to online disk arrays

Interface Manager

- Extends the intelligent management

Command View ESL

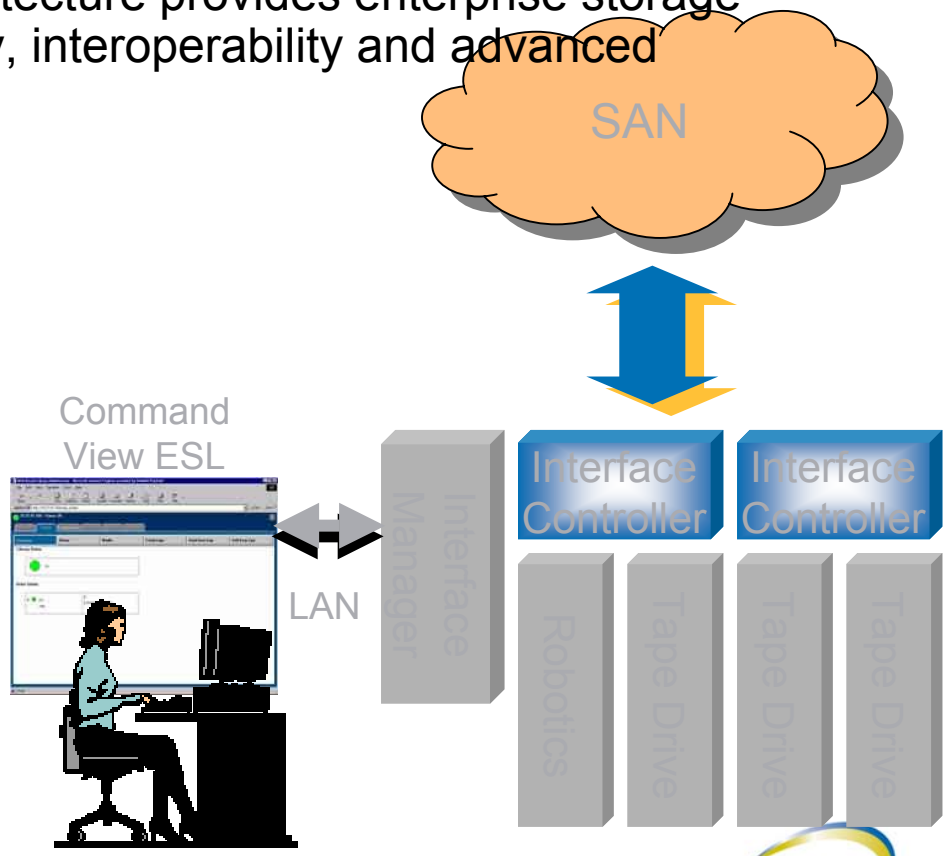
- A single pane of glass view of the entire library
- Delivers easy-to-use remote management

Direct Backup Engine

- For high performance direct backups

Secure Manager

- Blocks disruptive access to drives

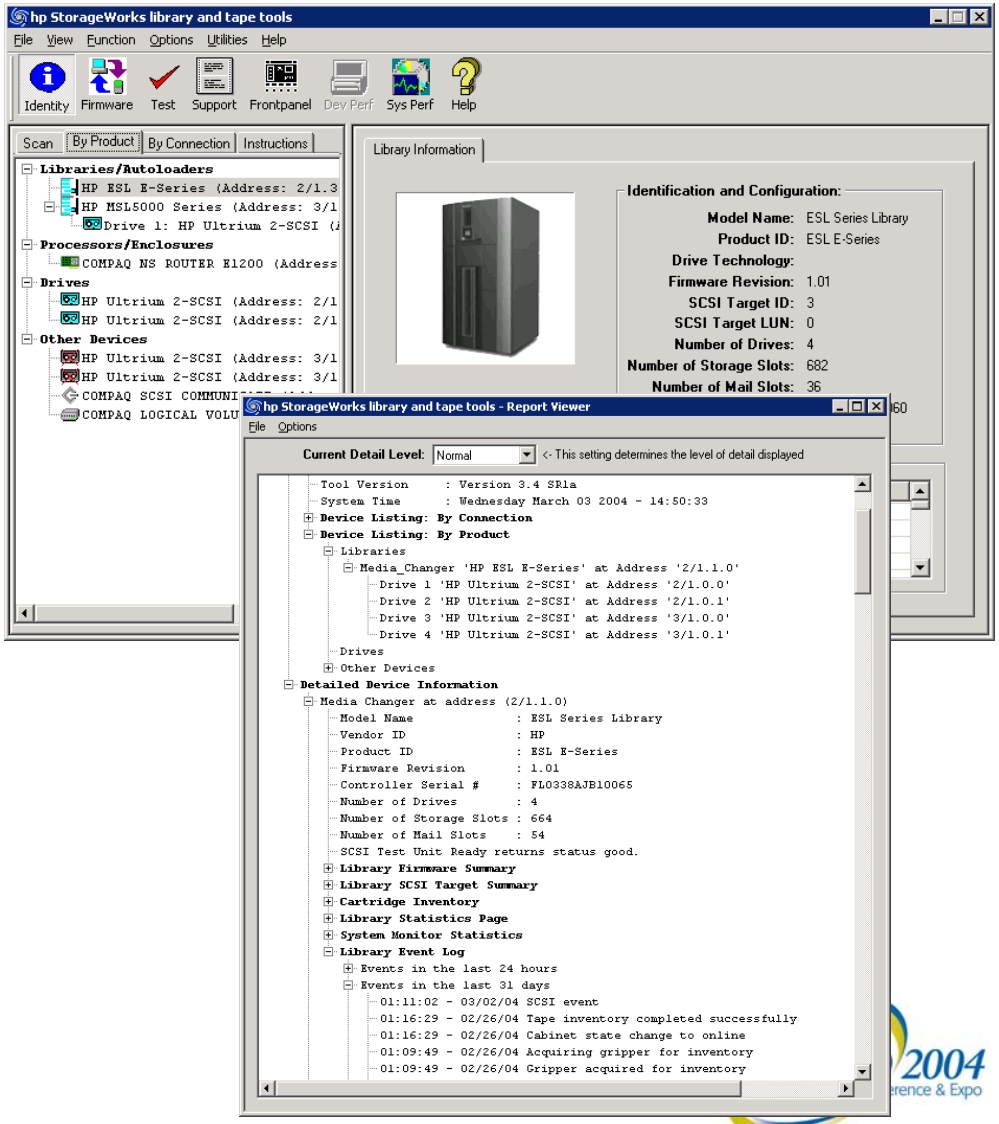


Self-aware storage designed for the SAN

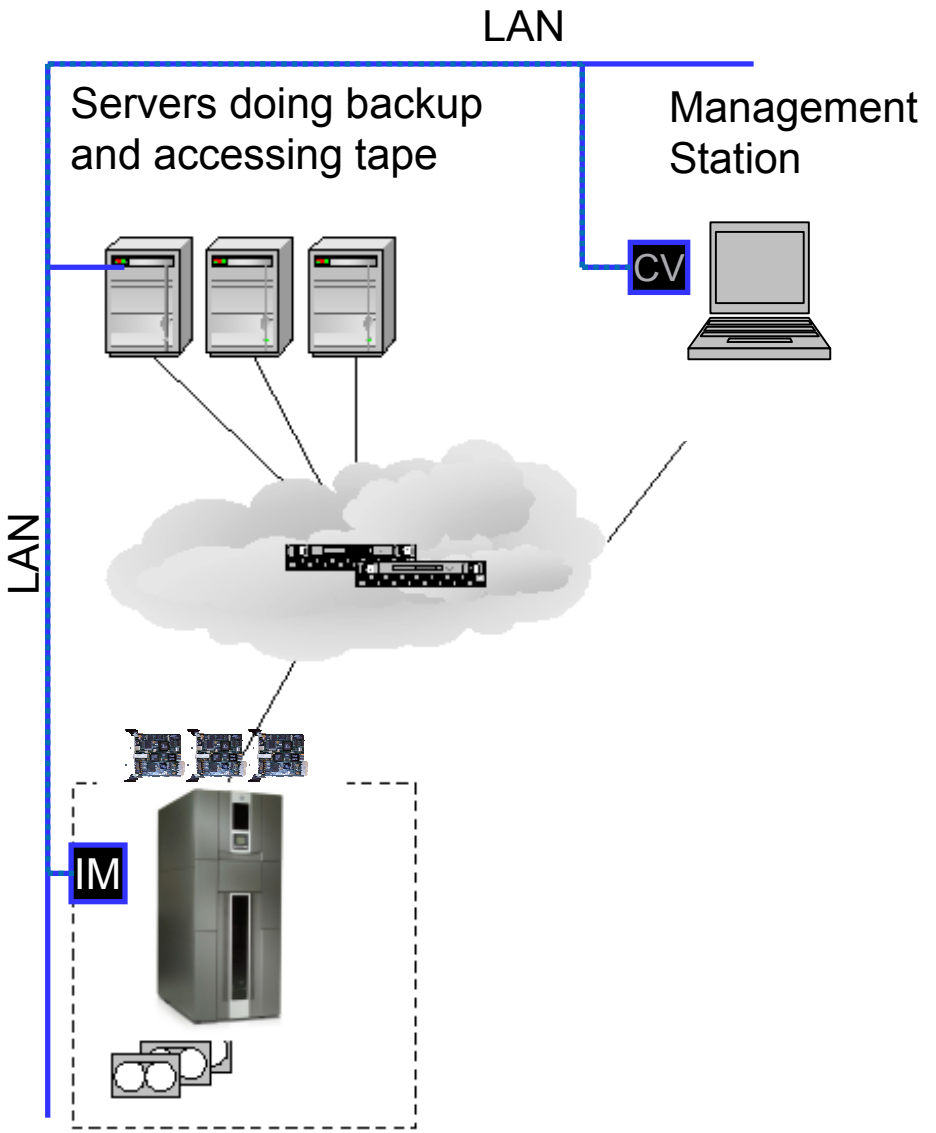
Improved Diagnostic

Embedded features of HP's Library & Tape Tools

- Easier firmware management
- Support ticket integration
- Improved SAN event logging



Diagnostics and Logs



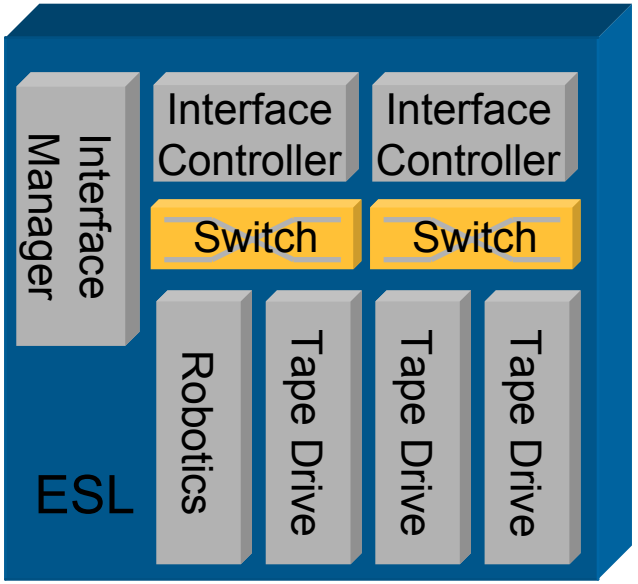
Reliability Benefit

- Events can be correlated with other backup logs to quickly identify root cause
- Diagnostic tests can be run to quickly pinpoint problems
- Operations performed out-of-band to avoid disrupting SAN activity

Extended tape library futures

With Native-FC tape drives

- FC – FC interface controller
- Dual ported FC drives
- Switched backend
- Offers better flexibility and bandwidth utilization



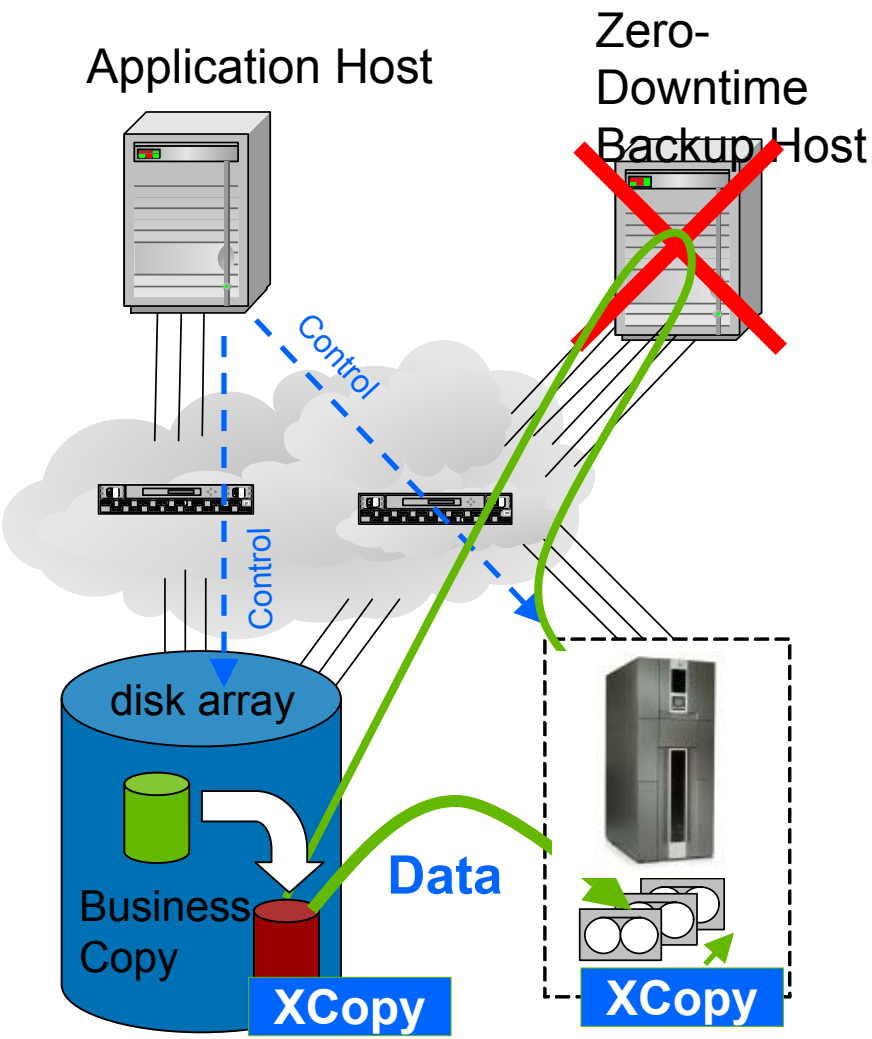
Tape controller functionality

- Tape command processing in the interface Controller
- Similar functionality to disk arrays

Allowing advanced features as:

- Tape mirroring
- Back-end path failover
- Disk buffering
- Spare tape drives

XCopy (Direct Backup)



Description

- Alternative to Zero-Downtime Backup:
  Doesn't require an additional server
- Backup app configures disk array and tape library to exchange data
- Disk array sends data directly to tape drives,
  without server "middle man"