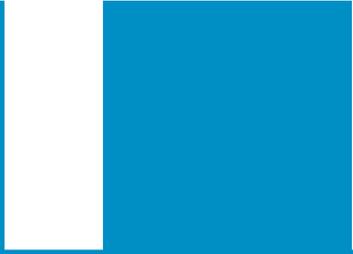
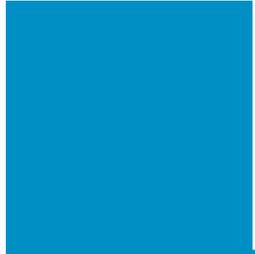


HP StorageWorks ESL E-Series
Enterprise Tape Libraries
Comparison with
HP StorageWorks 9000
Enterprise Tape Libraries



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Fig 1. HP Enterprise library family

ESL Portfolio




| | ESL9322 | ESL9595 | ESL E-Series |
|--|---------------------------------|---------------------------------|-------------------------|
| Cartridge count | 222, 322 | 400, 500, 595 | 712, 630 |
| Drive Technology | Ultrium 230/460 SDLT 220/320 | Ultrium 230/460 SDLT 220/320 | Ultrium 460 SDLT 320 |
| Drive count | 1-8 | 1-16 | 1-24 |
| Max. Native capacity (LTO 460/SDLT 320) | 64 TB / 51.5 TB | 119 TB / 95.2 TB | 142 TB / 100.8 TB |
| TB sq ft | 7.95 / 6.39 | 9.8 / 7.9 | 14.2 / 10 |

Executive summary

HP listens to customers. When starting to design its new line of enterprise class libraries, HP consulted widely with its customer base, storage analysts, and its technical consultants in the field to establish what features were important and which features could be improved with their current libraries. The result is a library architecture that can be implemented across the whole range of HP libraries both current and future. Moreover, for the first time HP tape libraries will provide self-aware tape storage specifically designed for use in your Storage Area Network (SAN).

With the introduction of the new HP StorageWorks ESL 712e and 630e Tape Libraries, and enhancements to the existing ESL 9000 range, HP can better meet the demands of its enterprise customers by providing:

- Tape libraries that are now fully SAN enabled (in the same way that disk arrays are), by utilizing HP StorageWorks Extended Tape Library Architecture (ETLA) to provide much better interoperability, reliability, and advanced features required to use a tape library in today's SAN environments.
- The best gigabyte per square foot density and gigabyte per hour throughput capability of any enterprise library at a competitive price.

- Investment protection. The entire range of the ESL family of libraries will support future SDLT and LTO technologies as they become available. In addition the architecture allows for easy migration to 4GB Fibre Channel (FC) and other storage networking protocols such as iSCSI, as they become available.

Whether you are an existing HP library customer who now needs better integration into a SAN or a prospective HP library customer evaluating potential suppliers, HP can provide a tape library to meet the most demanding of enterprise environments.

Target audience for this white paper

This white paper is aimed at end-user customers to enable them to understand the differences in the HP enterprise tape library offering. This white paper compares and contrasts the various library models to help customers make an informed purchasing decision and thereby provide long-term investment protection.

Fig 2. HP ESL E-Series library overview

HP StorageWorks ESL E-series tape library



Overview: For the enterprise IT administrator requiring highly reliable, network intelligent, Designed for the SAN. Unlike the competition, the ESL E-series platform offers highest density, broadest scalability, flexible enterprise drive technology, and Industry leading integrated manageability for the entire tape subsystem.

Flexible: Up to 24 tape drives in a single frame
Choice of Ultrium 460, SDLT320, Ultrium 460 NFC technologies

Scalable: One frame up to 712 LTO2 cartridges
One frame up to 630 SDLT320 cartridges
User configurable 18 LTO (16 SDLT), 36(32) or 54(48) slot load ports
Multi-unit scalability

Manageable: Remote manageability. Advanced backup features:
Secure Manager, Direct Backup.
Integrated with OV-SAM GUI interface.
Supports HP Extended Tape Library Architecture



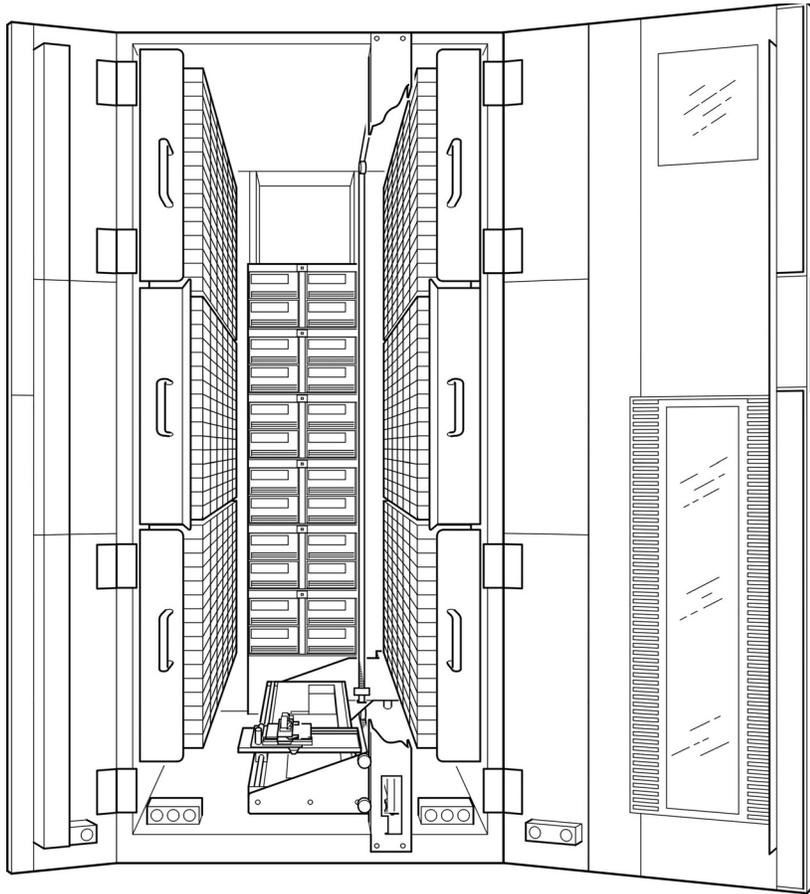
Introducing the HP StorageWorks ESL E-Series 712e and 630e Enterprise Tape Libraries

The HP ESL E-Series libraries represent a breakthrough in library design and integration into a SAN.

- Optimal use of space—drives, slots, and manageability components
- Four-unit drive clusters for maximum drive density
- Drive clusters also contain drive power monitoring and HP Interface Manager

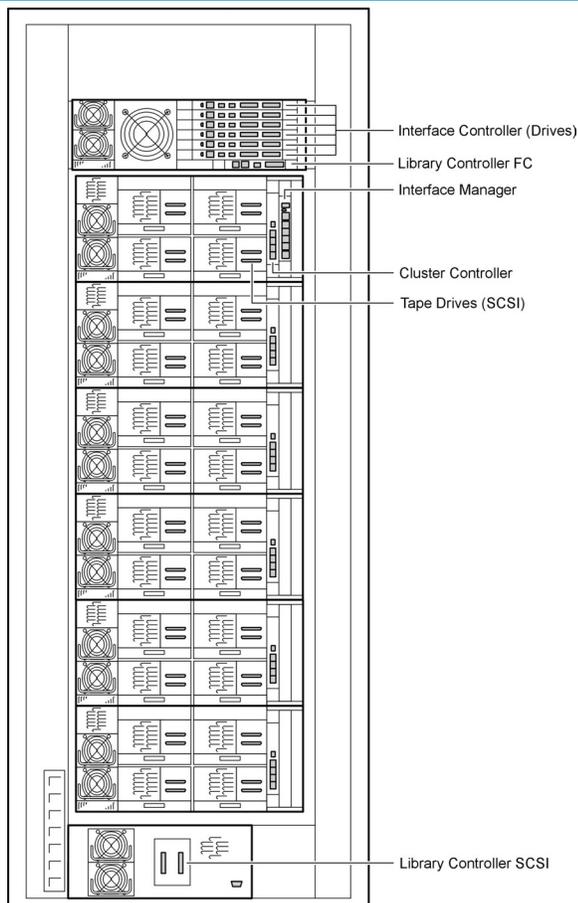
- Ergonomic load ports
- Reliable belt-driven robotics
- Built-in interface controller card cage
- Expandable to five frames using a cross-link mechanism (future offering)

Fig 3. HP ESL E-Series tape libraries
internal view



- In the ESL E-Series 720e model shown, the right load port can hold 32 SDLT or 36 Ultrium tapes and the left load port 16 SDLT or 18 Ultrium tapes. The use of these load ports is configurable.
- This illustration shows the maximum configuration of 24 tape drives in six drive clusters at the rear of the library.
- “Wall to wall” slot backs on the right and left walls. Other slots are available if the full complement of drive clusters is not installed.
- The media cartridge bins are on runners to facilitate initial bulk loading of media into the library.
- The belt-driven robotics are efficient.
- The overall slot count of the library is dependent on the number of drives installed and load port configuration selected.

Fig 4. HP ESL E-Series tape libraries rear view



- The Interface controllers connect the tape drives to the SAN and are located in the card cage at the top of the library.
- Each drive cluster contains a cluster controller used to monitor power supplies and allow communication between library controller and tape drives.
- The Interface Manager resides in the uppermost cluster controller card cage. The Interface Manager acts as a focal point of knowledge for the library and is connected by an internal LAN to all the major components within the library.
- The Command View ESL management console is connected by a LAN on the Interface Manager.

HP StorageWorks ESL E-Series libraries positioning

The ESL E-Series libraries are the latest addition to the HP ESL series of libraries. Drive upgrades and on-going interoperability testing will continue on both ESL 9000 and ESL E-Series platforms. The ESL E-Series platform, however, offers some important advantages over the ESL that some customers will value:

- More than 500 cartridge slots
- High storage and drive density

- Native FC tape drives
- Tape technology support beyond SDLT600 and LTO3
- Higher scalability (up to 116 drives and 3,050 slots)
- Higher capacity load ports (up to 54 tapes at a time)
- The full range of advanced features offered through the ETLA

The ESL 9000 series libraries will also have many of the important manageability and advanced features offered through the ETLA. Customers should choose an ESL 9000 series library when:

- The customer needs 200 to 500 slots.
- The customer wants to expand an existing ESL 9000 series library.

- The customer needs SDLT220, Ultrium 230 drive technology, and/or mixed drive capability within the same library.
- The manageability and certain advanced features offered by the ETLA. ESL 9000 series libraries can be ordered as a complete bundled ETLA solution using a single SKU.

For a complete comparison of ESL 9000 and ESL E-Series libraries, see Appendix 1. For a summary of why HP thinks the E-series is a winning platform, see Appendix 2.

Fig 5. When to choose ESL E-Series libraries

HP ESL Tape Libraries: ESL portfolio positioning




ESL9000 series is the right solution when:

1. Customer needs 200 – 500 cartridge slots
2. Customer wants to expand current installed ESL9000's via pass through mechanism
3. Customer wants all ETLA components bundled together into one sku: ESL Extended Libraries
4. Customer needs SDLT220 or Ultrium 230 drive technology and/or mixed drive capability

ESL E-Series is the right solution when:

1. Customer needs 500+ cartridge slots
2. Customer requires high storage and drive density
3. Customer requires Native Fibre tape drives*
4. Customer requires removable magazines and bulk loading/unloading*

*not available at launch

ETLA

Both ESL 9000 extended and ESL E-Series libraries support ETLA.

Fig 6. ETLA

The hp StorageWorks extended tape library architecture



Interface Controllers

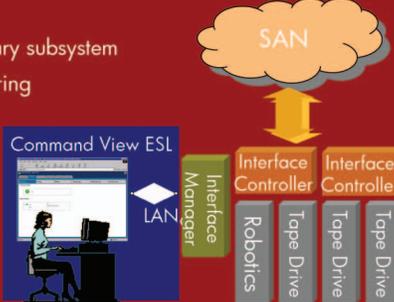
- Layer of intelligence between tape drives and the SAN
- Manages shared access to the tape library, intelligently handling conflicts and storage network events
- Similar architecture to disk-arrays with controllers in front of disk drives

Interface Manager

- Extends the intelligent management
- A central point of knowledge for the entire tape library subsystem
- Enables remote management & performance monitoring

Command View ESL

- A single pane of glass view of the entire library
- Delivers easy-to-use remote management
- Provides wizards for setup and configuration
- Simplifies and automates the most complex tasks
- Stays *out* of the SAN to allow critical traffic to flow



ETLA will save library and SAN administrators time and money by simplifying library setup, configuration, and troubleshooting. HP controller-based architecture increases reliability and robustness of libraries in the SAN and integrates with leading enterprise management applications.

ETLA currently consists of the following integrated components:

- HP StorageWorks ESL 9322, ESL 9595, ESL 712e, and ESL 630e enterprise tape libraries, with a choice of Ultrium 460 or SDLT 320 tape drives
- HP StorageWorks Fibre Channel Interface Controller e2400-160
- HP StorageWorks Fibre Channel Interface Controller e1200-160 (used for library robotics control)
- HP StorageWorks Interface Manager card
- HP StorageWorks Command View ESL software
- HP StorageWorks Direct Backup Engine ESL
- HP StorageWorks Secure Manager ESL

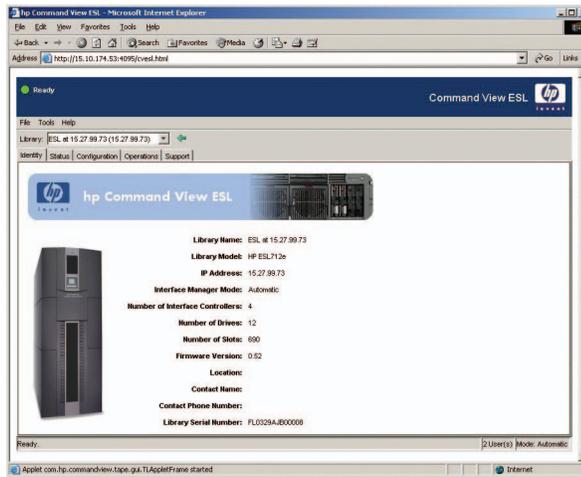
Acting together, these integrated components can:

- Decrease both costs and administrative work through enhanced manageability from any location

- Deliver best-in-class interoperability **without** “special” work-arounds
- Simplify the complex task of setting up library robotics, drives, and interface controllers in a SAN
- Minimize uncertainty in complex SAN environments by allowing only authorized servers to access tape drives and critical data (Secure Manager option)
- Eliminate backup server and LAN bottlenecks by allowing data to move directly from disk to tape under the control of your backup application—without application server overload
- Provide investment protection by enabling an easy upgrade path as interface technologies change (Direct Backup option)

Currently installed ESL 9198, ESL 9326, ESL 9322, and ESL 9595 tape libraries can upgrade to the ETLA with Interface Manager and Command View ESL upgrade kits and software licenses. New ESL Extended library solutions that include a library frame, card cage, Interface Manager card, Command View ESL software, and permanent software licenses are also available. The ETLA will grow over time to support a wide range of library platforms and advanced features.

Fig 7. Command View ESL — Library management console



Compatibility/ Interoperability

As the compatibility and interoperability are continually being enhanced, users should consult <http://www.hp.com/go/ebs>.

Frequently asked questions

1. Why is HP introducing the E-series libraries?

- To better meet customer needs in terms of drive density and storage capacity density
- To provide a new platform for increased scalability and to satisfy the needs of the most demanding enterprise environments
- To provide a platform capable of supporting the wide range of advanced features being developed under ETLA, such as native FC tape drive support

2. Does this mean the ESL 9000 series will be discontinued?

No. Compatibility testing will continue on both the ESL 9000 series and the ESL 9000 extended series. When available, SDLT600 and LTO3 technologies will be introduced and supported on the ESL 9000 and ESL 9000 extended series libraries via drive upgrade kits.

3. Is the ETLA architecture expensive?

- Aggregating multiple tape drives per FC link can recover much of the cost over a non-controller solution, where every tape drive must have a dedicated FC port.

- Reduced administration effort improves the total cost of ownership.
- Advanced functionality/monitoring capability is only achievable by having a controller-based architecture, which provides better value and return on investment (ROI). In most cases the ETLA architecture will be no more expensive than competitors' offerings but will provide much better manageability, diagnostic capabilities, and feature sets.

4. When should I choose an ESL9000 and when should I choose an ESL E-Series library?

Choose ESL 9000 series libraries with ETLA if you require a reliable library with expansion and upgrade options and the following features:

- Maximum slot count of 500 slots
- SDLT220 or Ultrium 230 drive technology support specifically
- LTO2 and SDLT320 support together with SDLT600 and LTO3 technology support when available
- Advanced manageability, diagnostics, and SAN event reporting offered through Command View ESL
- Easy configuration through Command View ESL
- Secure Manager option for best-in-class host access control
- Mixed drive technology libraries—LTO and SDLT in the same library
- Multi-unit scalability up to 64 drives and 2,278 slots

Choose ESL E-Series libraries if you require a reliable library with highest possible scalability and the following features:

- Slot count of more than 500 slots
- Drive count (for increased performance) of more than 16 drives
- Specific requirement for native FC tape drives
- LT0460, SDLT320, LT0460 NFC, next generation drive technologies, and beyond
- Advanced manageability, diagnostics, and SAN event reporting offered through Command View ESL
- Easy configuration through Command View ESL
- Secure Manager option for best-in-class host access control
- Multi-unit scalability up to 116 drives and 3,000 slots (future)
- Further advanced ETLA features (see Appendix 1)

5. When will multi-unit scalability be available for the HP ESL E-Series libraries?

Probably late in 2004, firmware enhancements will be required for ETLA Interface Manager controller to support multi-unit libraries. Additional cross-link mechanisms must be purchased to enable multi-unit scalability.

Glossary of Terms

Command View ESL

Command View—The “common look and feel” management console for all HP storage devices

Command View—The specific HP management console for ESL 9000 extended and ESL E-Series libraries

Direct Backup

Sometimes known as serverless backup, Direct Backup is the ability for the interface controller to transfer data directly from the disk to tape without the data having to pass through the application server. Significantly reduces the server loading.

Drive Cluster

HP terminology for the mounting unit used to hold up to four tape drives within the ESL E-Series tape libraries.

ESL Libraries

Enterprise System Libraries

ESL 9000—ESL 9322 and ESL 9595 without ETLA components

ESL 9000—Extended ESL 9322 and ESL 9595 with ETLA embedded

ESL E-Series—ESL 712e and 630e, featuring a new library platform and embedded ETLA

Interface Controller

HP terminology for the controller that links the tape drives to the SAN. More than a storage router, this controller can manage, report to, and be configured by the Interface Manager. It also possesses additional features, such as Direct Backup, LUN masking, failover capability, and so on. Interface controllers are available with FC-SCSI today and FC-FC in early 2004. Further versions can be produced to accommodate new storage networking protocols such as iSCSI.

Interface Manager

The central point of knowledge for all activities within the library. The Interface Manager communicates with the interface controllers and library controller on one side and the management console (through Command View ESL) on the other.

Native Fibre Channel (NFC) Tape Drives

These tape drives use 2GB Fibre connections on the rear of the drives instead of the 68-pin SCSI connections.

Inside the NFC drive, the drive firmware unpacks the SCSI command from within the FC protocol and executes them within the tape drive. The cabling is therefore simpler with native FC tape drives, and because FC is a networked protocol, it allows “many to many” connections, unlike SCSI, which tends to be “point to point” connections. NFC drives will allow data path failover within the library itself.

There is no performance advantage of NFC drives compared to SCSI drives as both interfaces are much faster than the tape drives can physically write or read.

Secure Manager

This feature within ETLA allows specific hosts only to access specific tape drives within a library and acts as a means of ensuring certain tape devices are always available to critical applications. Without Secure Manager, the default configuration is all hosts see all tape drives.

HP StorageWorks Secure Path implements the security at the FC protocol level and not the ISV software level.

Virtualization

Virtualization is the ability to hide the complexity of a storage subsystem by presenting it to hosts as LUNs or volumes, instead of a series of discrete devices.

Appendix 1 — Features comparison

| Feature | ESL9322/9595 L1 | ESL9322/9595 S2 | ESL9322/9595 L2 | ESL 712e | ESL 630e |
|---|--|--|--|--|--|
| Number of tape drives | 1-8/1-16 | 1-8/1-16 | 1-8/1-16 | 1-24 | 1-24 |
| Number of media slots | 222 or 322/ 400 or 500 or 595 (Note 1) | 222 or 322/ 400 or 500 or 595 (Note 1) | 222 or 322/ 400 or 500 or 595 (Note 1) | 712 (Note 2) | 630 (Note 2) |
| Maximum native performance (GB/hr) per single library | 432/864 | 461/922 | 864/1728 | 2,592 | 1,382 |
| Maximum native capacity (TB) per single library | 32.2/64.4 | 51.5/95.2 | 64.4/119 | 142.4 (Note 9) | 100.8 (Note 9) |
| Number of media in mail slot | 8 | 8 | 8 | Customer chooses either 16, 32, or 48 (Note 3) | Customer chooses either 16, 32, or 48 (Note 3) |
| Robotics reliability (MSBF) | 3 million | 3 million | 3 million | 1 million at launch, 3 million over time | 1 million at launch, 3 million over time |
| Slot to drive time | 6 s | 6 s | 6 s | 6 s | 6 s |
| Cartridge swaps/hour | 180 | 180 | 180 | TBC | TBC |
| Inventory time | <7 min | <7 min | <7 min | <5 min | <5 min |

| Feature | ESL9322/9595 L1 | ESL9322/9595 S2 | ESL9322/9595 L2 | ESL 712e | ESL 630e |
|--|------------------------|------------------------|------------------------|---------------------|---------------------|
| Bulk media loading | YES | YES | YES | YES (Note 7) | YES (Note 7) |
| Scaleability (number of enclosures) | 5 for 9322, 4 for 9595 | 5 for 9322, 4 for 9595 | 5 for 9322, 4 for 9595 | 5 (Note 5) | 5 (Note 5) |
| Embedded IF controllers | YES | YES | YES | YES (Note 8) | YES (Note 8) |
| Hot swap drives | YES | YES | YES | YES | YES |
| Redundant power supplies | YES (2N) | YES (2N) | YES (2N) | YES (DUAL) (Note 6) | YES (DUAL) (Note 6) |
| Dual AC input | YES | YES | YES | YES | YES |
| Power consumption | 1,200 W/ 1,600 W | 1,200 W/ 1,600 W | 1,200 W/ 1,600 W | Max 1,600 | Max 1,600 |
| Redundant fans | YES | YES | YES | NO (Note 13) | NO (Note 13) |
| Interface Manager support | YES (Note 10) | YES (Note 10) | YES (Note 10) | YES (Note 10) | YES (Note 10) |
| Command View ESL support for configuration, diagnostics, and manageability | YES | YES | YES | YES | YES |
| Direct Backup support (serverless) | YES (Note 11) | YES (Note 11) | YES (Note 11) | YES (Note 11) | YES (Note 11) |
| Secure Manager support | YES (Note 12) | YES (Note 12) | YES (Note 12) | YES (Note 12) | YES (Note 12) |

| Feature | ESL9322/9595 L1 | ESL9322/9595 S2 | ESL9322/9595 L2 | ESL 712e | ESL 630e |
|--|--|--|--|--|--|
| Mixed drive and media support | YES | YES | YES | YES but at a future date | YES but at a future date |
| Diagnostics | HP Library and Tape Tools from a server connected to library (ESL 9000 series) Diagnostics integrated into management console through Command View ESL (ESL 9000 extended series) | HP Library and Tape Tools from a server connected to library (ESL 9000 series) Diagnostics integrated into management console through Command View ESL (ESL 9000 extended series) | HP Library and Tape Tools from a server connected to library (ESL 9000 series) Diagnostics integrated into management console through Command View ESL (ESL 9000 extended series) | Diagnostics integrated into management console through Command View ESL HP Library and Tape Tools can be run externally (from host) if required | Diagnostics integrated into management console through Command View ESL HP Library and Tape Tools can be run externally (from host) if required |
| Enterprise management software support | OpenView SAM HP Insight Manager for ProLiant HP OpenView Network Node Manager CA Unicenter TNG Tivoli Storage Manager | OpenView SAM HP Insight Manager for ProLiant HP OpenView Network Node Manager CA Unicenter TNG Tivoli Storage Manager | OpenView SAM HP Insight Manager for ProLiant HP OpenView Network Node Manager CA Unicenter TNG Tivoli Storage Manager | OpenView SAM HP Insight Manager for ProLiant HP OpenView Network Node Manager CA Unicenter TNG Tivoli Storage Manager | OpenView SAM HP Insight Manager for ProLiant HP OpenView Network Node Manager CA Unicenter TNG Tivoli Storage Manager |

Notes:

1. ESL 9322 ships with 322 physical slots, 222 enabled as standard upgradeable to 322 through an upgrade license. ESL 9595 ships with 595 physical slots, 395 enabled as standard upgradeable to 495 and 595 through upgrade licenses.
2. All slots enabled by default.
3. Sixteen on the left side of the library and 32 on the right side of the library for LTO. Fourteen on the left side and 28 on the right side for SDLT. At launch, these load ports are functional but not removable (removable load port magazines planned for mid 2004).
4. As normal product improvement proceeds.
5. Not initially available at launch.
6. Dual Redundant Power Supply Units (PSUs) and dual AC supply. However, if an AC supply to a cluster is lost, up to four drives are lost.
7. Bulk loading is easier on the 712e/630e libraries because the slot panels extend out of the library on runners.
8. Interface controller card cage included as standard (optional on ESL 9322/9595).

Notes (Cont'd):

9. Unused drive space is used as slot space, so the maximum number of slots used in this example is with one to four drives. See Appendix 2. Each drive cluster equates to 14 (LTO) or 12 (SDLT) slots.
10. Interface Manager is an optional upgrade for ESL, but it is shipped as default with ESL Extended Libraries.
11. This is an option at extra cost. See Appendix 2. Limited system support at this time.
12. Default Secure Manager setting is all hosts see all drives. For more flexible configurations, a Secure Manager license (option) should be purchased.
13. Design is different and does not require "master cooling." Each module has its own self-contained cooling.

| Future Features | ESL9322/9595 L1 | ESL9322/9595 S2 | ESL9322/9595 L2 | ESL 712e | ESL 630e |
|--|------------------------------------|------------------------------------|------------------------------------|--|--|
| Support of drive technology | Up to SDLT600 and LTO3 (SCSI only) | Up to SDLT600 and LTO3 (SCSI only) | Up to SDLT600 and LTO3 (SCSI only) | SDLT600 and LTO3 (SCSI and native FC) and beyond | SDLT600 and LTO3 (SCSI and native FC) and beyond |
| Support of library partitioning | YES | YES | YES | YES | YES |
| Support of performance monitoring | Under review | Under review | Under review | YES | YES |
| Support of enhanced path failover | Under review | Under review | Under review | YES | YES |
| Support of native FC tape drives | NO | NO | NO | YES | YES |
| Support of SNIA SMI-S Management Interface | YES | YES | YES | YES | YES |

Appendix 2 — How HP wins in the enterprise library market

With the addition of the ESL E-Series to the HP enterprise library family and the increasingly advanced features offered by the HP Extended Library Architecture, HP feels it is well placed compared to the competition in offering the most well-integrated and cost-effective tape libraries for use in a SAN with maximum intelligence and network functionality.

HP offers:

- Better cost-effective SAN integration than any other library vendor, especially the expensive virtual tape server vendors (no other library vendor management console can supply the configuration capabilities together with the depth and quality of information that Command View ESL can)
- Maximum flexibility in terms of:
 - I. Drive technologies supported (SDLT, LTO, and native FC)
 - II. Load port configurations
 - III. Slot count configurations
 - IV. Drive count configurations
- Maximum scalability
 - I. Industry-leading density of 28 TB/sq ft
 - II. Family scales up to 116 drives and 3,050 slots

- Feature sets

- I. Advanced manageability through Command View ESL
- II. Ease of configuration through Command View ESL
- III. SAN event Logging through Command View ESL
- IV. Mixed drive support (ESL 9000 currently, ESL E-Series later in 2004)
- V. Redundant power supplies for high availability
- VI. Hot swap tape drives for high availability
- VII. Easy serviceability and access
- VIII. Secure Manager
- IX. Direct Backup
- X. On-going ETLA roadmap for future new feature integration
 - a. Native FC tape drive support
 - b. Partitioning
 - c. Data path failover
 - d. Performance optimizer

For more information

<http://www.hp.com/go/automation>

“Choosing the best architecture for data protection in your SAN” and other tape library related whitepapers can be found at:

<http://h18006.www1.hp.com/storage/tapewhitepapers.html>

To learn more about HP's offering, visit www.hp.com.

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