Chapter 1 : " Introduction "

This chapter will introduce you to your new Disk Array's features and provide information on general RAID concept.

Features

This section provides an overview of the features. For more detailed information, please refer to the technical specifications appendix at the end of this manual .
Your Disk Array includes the following features :

Easy Operation

As everyone knows, conventional Disk Arrays are designed for experienced computer specialists. To solve complicated and time consuming operating procedures, we came up with a revolutionary idea :

-- Innovative Plug And Play RAID --

As compared to a conventional Disk Array's long-winded setup procedures, your Disk Array can be ready to go after using the simple step by step built-in setup program.

Ultra High performance

Your Disk Array combines an extremely high speed microprocessor with the latest chip set, SCSI hardware technology , perfect firmware and an artistic design. The result is one of the fastest, most reliable Disk Array systems on the market.

- Supports virtually all popular operating systems ,platforms and network environments because it works independently from the O.S.
- Ultra 160 LVD SCSI channel interface to your Host computer, up to 160MB data transfer rate provides the processing and access power for you to handle complex and large files.
- Selective SCSI ID 0 ~ 14 , support with active termination.
- Tagged-command queuing : allows processing of up to 255 simultaneous data requests.
- Selective RAID levels 0, 1, 0+1, 3 or 5.
- Build-in 64MB cache memory, expandable up to 512MB.
- Serial communication port (Terminal Port) permits array controller operation through a standard VT100 terminal (or equivalent).

Solid reliability

- Automatic failed disk drive detection.
- Auto rebuild : when a replacement disk installed (or by using hot spare disk), The system provides automatic data rebuild without any commands or functions keyed in. (Transparent to Host)

Efficient maintenance

- An LCD status panel displays a comprehensive readout of the operating status, and the HDD LED indicators on each HDD tray display the individual HDD status.
- When disk failure occurs on a member disk of the disk array, the built-in buzzer sounds simultaneously and LCD status panel also points out the location of the failed hard disk drive. In the meantime the LED HDD status indicator will light up " Red "on the failed HDD tray , according the LED indicator on the HDD tray you can perform quick, efficient and correct maintenance.
- Hot Swap : allows you can remove and install the " Hot Swap " parts without interrupting data access while the system is on.
- The " Hot Swap " parts include the Hard Disk Drive, Redundant Power Supply Unit and Cooling Fan.

General RAID Concepts

Correct installation of the disk array requires an understanding of RAID technology and the concepts described in this section.

Definition

RAID is an acronym of Redundant Array of Independent Disks .
A RAID is a Disk Array in which part of the storage capacity is used to record redundant information about the user data stored on the remainder of the storage capacity. The redundant information enables regeneration of user data in the event that one of the Array's member Disks or the access path to it fails.

Benefits of RAID

1. Secure Data

RAID is an emerging storage technology with the potential to revolutionize the data storage technology. A typical RAID unit contains a set of disk drives, typically two to six, which appear to the user to be equivalent to a single large capacity disk drive. The remarkable benefit of disk array is that if any single disk in the RAID fails, the system and array still continues to function without loss of data. This is possible because the redundancy data is stored on separate disk drives and the RAID can reconstruct the data that was stored on the failed disk drive.

2. Increases system performance

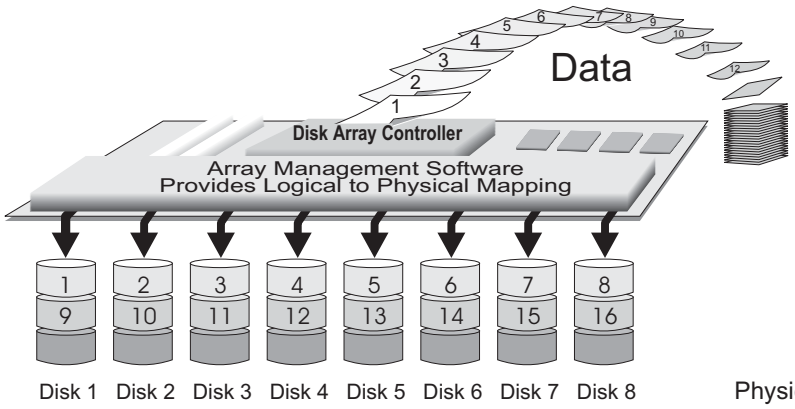
As the effective seek time for finding data on a disk can potentially be reduced by allowing multiple simultaneous access of different data on different disks. Utilizing parallel reads and writes of the data spread across the disks in the array, the data transfer rate can be increased significantly over that of a single disk.

3. Easy maintenance

RAID system maintenance is typically simplified because it is easy to replace individual disks and other components while the system continues to function. (Hot swap support)

RAID Levels

RAID Level 0 : " Disk Striping " High I/O Performance



● Improved I/O performance is the major reason for using RAID level 0.

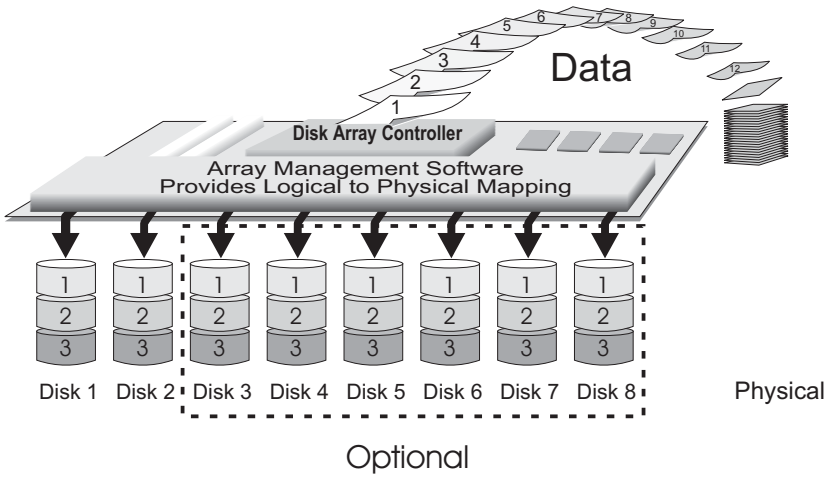
No protection is provided against data loss due to member disk failures. A RAID level 0 array by itself is thus an unsuitable storage medium for data that can not easily be reproduced, or for data that must be available for critical system operation. It is more suitable for data that can be reproduced or is replicated on other media.

A RAID level 0 array can be particularly useful for :

- Storing program image libraries or runtime libraries for rapid loading, these libraries are normally read only.
- Storing large tables or other structures of read only data for rapid application access. Like program images, the data should be backed up on highly reliable media, from which it can be recreated in the event of a failure.
- Collecting data from external sources at very high data transfer rates.

- RAID level 0 arrays are not particularly suitable for :
  - Applications which make sequential requests for small amount of data. These applications will spend most of their I/O time waiting for disks to spin, whether or not they use striped arrays as storage media.
  - Applications which make synchronous random requests for small amounts of data.

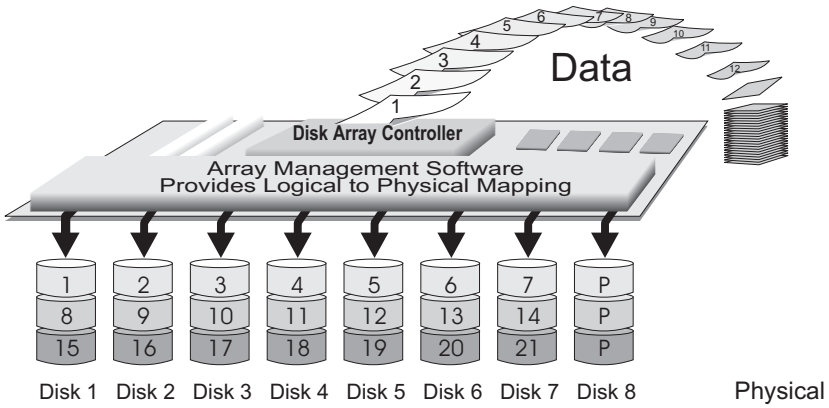
RAID Level 1 : " Disk Mirroring " High Data reliability



RAID level 1 provides both very high data reliability and continued data availability in the event of a failure of an array member. When a RAID level 1 member disk fails, array management software simply directs all application requests to the surviving member.

RAID level 1 is suitable for data for which reliability requirements are extremely high, or for data to which high performance access is required, and for which the cost of storage is a secondary issue.

RAID Level 3 :
" Parallel Transfer Disks with Parity "
High Data Reliability & Highest Transfer Capacity



P : Parity

RAID Level 3 technology use a dedicated parity disk to store redundant information about the data on several data disks. RAID Level 3 is an excellent choice for applications which require single stream I/O with a high data transfer rate.

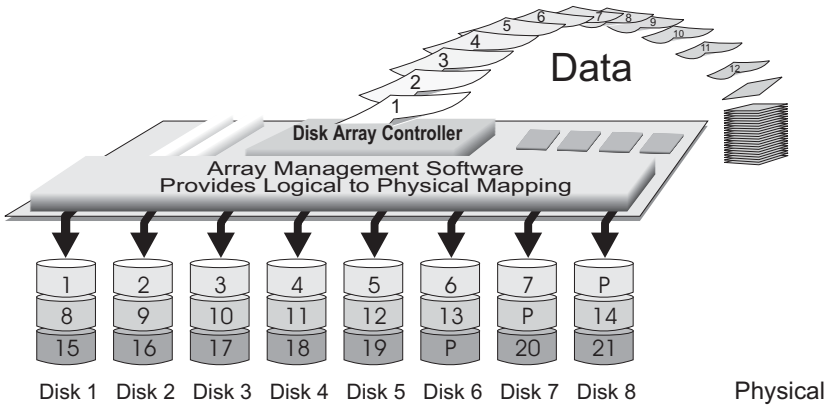
RAID Level 3 is optimal for applications in which large block of sequential data must be transferred quickly, these applications are usually of one of these types :

- They operate on large data objects such as graphical image processing, CAD/CAM files, and others.
- They are non-interactive applications that process large data sequentially.

They usually request a large amount of data (32KBytes or more) with each I/O request.

- The distinctive performance characteristics of RAID Level 3 :
  - RAID Level 3 provides excellent performance for data transfer-intensive applications.
  - RAID level 3 in not well suited for transaction processing or other I/O request-intensive applications.

RAID Level 5 :
" Independent Access Array with Rotating Parity "
High Data Reliability & Transfer Capacity



P : Parity

When RAID Level 5 technology is combined with cache memory to improve its write performance, the result can be used in any applications where general purpose disks would be suitable.

For read only or read mostly application I/O loads, RAID Level 5 performance should approximate that of a RAID Level 0 array. In fact, for a given user capacity, RAID Level 5 read performance should normally be slightly better because requests are spread across one more members than they would be in a RAID Level 0 array of equivalent usable capacity.

- A RAID level 5 array performs best in applications where data and I/O load characteristics match their capabilities :
  - Data whose enhanced availability is worth protecting, but for which the value of full disk mirroring is questionable.
  - High read request rates.
  - Small percentage of writes in I/O load.

- RAID level 5 arrays have unique performance characteristics :
  - The data can be recalculated or regenerated, using parity, when any drive in the array fails.
  - When the failed drive is replaced, either automatically if the subsystem contained a hot spare drive, or by user intervention during a scheduled maintenance period, the system will be restored its full data redundancy configuration by rebuilding all of the data that had been stored on the failed drive onto the new drive. This is accomplished using parity information and data from the other data disks. Once the rebuild process is complete, all data is again protected from loss due to any failure of a single disk drive.

Summary Comparison of RAID Levels

RAID Level	Common Name	Description	Array's Capacity	Data Reliability	Data Transfer Capacity
0	Disk Striping	Data distributed across the disks in the array. No redundant Information provided.	(N) disks	Low	Very High
1	Mirroring	All data Duplicated	1*disk	Very High	High
3	Parallel Transfer Disks with Parity	Data sector is subdivided and distributed across all data disk. Redundant information stored on a dedicated parity disk.	(N-1) disks	Very High	Highest of all listed alter-natives
5	Independent Access Array with Rotating Parity	Data sectors are distributed as with disk striping, redundant Information is interspersed with user data.	(N-1) disks	Very High	Very High

Supported RAID Levels

Based on the needs of a Disk Array's capacity, data availability, and overall performance, you can select a proper RAID level for your Disk Array. The supported RAID levels are shown in below :

RAID Level	Function Description	Drives required Min.	Max.
0	"Disk Striping" , block striping is used, which yields higher performance than with the individual disk drives. * There is no redundant function.	2	8
1	"Disk Mirroring" , Disk drives are mirrored , All data is 100% duplicated on each equivalent disk drives. * High Data Reliability	2	8
3	" Parallel Transfer Disks with Parity ", Data is striped across physical drives. Parity protection is used for data redundancy.	3	8
5	" Independent Access Array with Parity ", Data is striped across physical drives. Rotating Parity protection is used for data redundancy.	3	8
0+1	" Disk Striping " + " Disk Mirroring " Function.	4	8

Multi-SCSI Format support

The Disk Array provides one LVD Ultra 160 SCSI channel for connect to your host system. With proper cabling, it may support Narrow or Wide; Standard, Fast or Ultra /Ultra 2 /Ultra 160 SCSI formats.
(single ended)

Overall cable length
For secure data transfer , please refer to the cable length limitations as below :

* Cable length = External Host cables length + Internal Host cable length
* Standard Disk Array External cable length = 90cm (3 ft)
* Standard Disk Array Internal cable length = 20cm

SCSI Type	Clock Rate	Data Rate	Maximum Cable Length	Cable Required	Remark
LVD Ultra 160 (16 bit)	40 MHZ	160 MB/sec	12m	HPD 68--- HPD 68 pin	
LVD Ultra 2 (16 bit)	40 MHZ	80 MB/sec	12m	HPD 68--- HPD 68 pin	
Ultra wide (16 bit)	20 MHZ	40 MB/sec	2m	HPD 68--- HPD 68 pin	
Ultra SCSI (8 bit)	20 MHZ	20 MB/sec	2m	HPD 68--- HPD 50 pin	
SCSI 2 (8 bit)	10 MHZ	10 MB/sec	3m	HPD 68--- Cen. 50 pin	