Chapter 1 Introduction

The IFT-6300 is a RAID array controller and enclosure designed to house and manage data storage on IDE hard drives. The following sections give a brief overview of the concept of RAID arrays, explain the basics of what the IFT-6300 is comprised of, and introduces some of its more important features.

1.1 RAID

Redundant Array of Inexpensive Disks (RAID) is a storage technology used to improve the processing capability of storage systems. This technology is designed to provide reliability in disk array systems and to take advantage of the performance gains offered by an array of multiple disks over single-disk storage.

RAID's two primary underlying concepts are (1) that distributing data over multiple hard drives improves performance and (2) that using multiple drives properly allows for any one drive to fail without loss of data and without system downtime. In the event of a disk failure, disk access will continue normally and the failure will be transparent to the host system.

Originally designed and implemented for SCSI drives, RAID principles have been applied to IDE drives in the IFT-6300.

> ***NOTE:***
> The IFT-6300 has been designed to tolerate a single fault in any major component except the controller itself. Drives, fans, power supplies, one of any (or even "each" under worst case) can fail and data will still be maintained and available.

RAID has six levels: RAID 0 ~ 5. RAID levels 1, 3 and 5 are the most commonly used, while RAID levels 2 and 4 are rarely implemented.

The IFT-6300 does not support a non-RAID storage configuration, thus a minimum of two hard drives must be installed. The following sections describe in detail each of the commonly used RAID levels.

IMPORTANT!
The IFT-6300 only supports RAID 0, RAID 1, RAID 3, RAID 5, RAID 1+Spare, RAID 3+Spare, and RAID 5 +Spare. Auto Setup default RAID settings are described in Chapter 2.

Non-RAID Storage

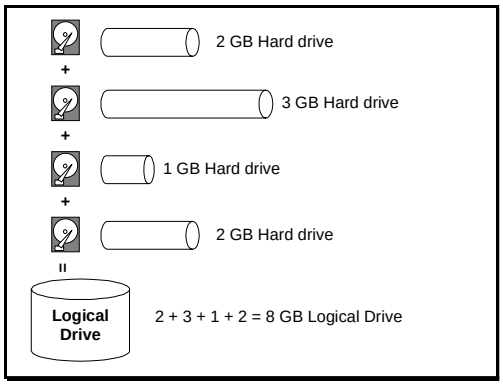
One common option for expanding disk storage capacity is simply to install multiple disk drives into the system and then combine them end to end. This method is called *disk spanning*.

(Note that the IFT-6300 does not support non-RAID storage.)

In disk spanning, the total disk capacity is equivalent to the sum of the capacities of all IDE drives in the combination. This combination appears to the system as a single logical drive. Thus, combining four 1GB IDE drives in this way, for example, would create a single logical drive with a total disk capacity of 4GB.

Disk spanning is considered non-RAID due to the fact that it provides neither redundancy nor improved performance. Disk spanning is inexpensive, flexible, and easy to implement; however, it does not improve the performance of the drives and any single disk failure will result in total data loss.

Non-RAID



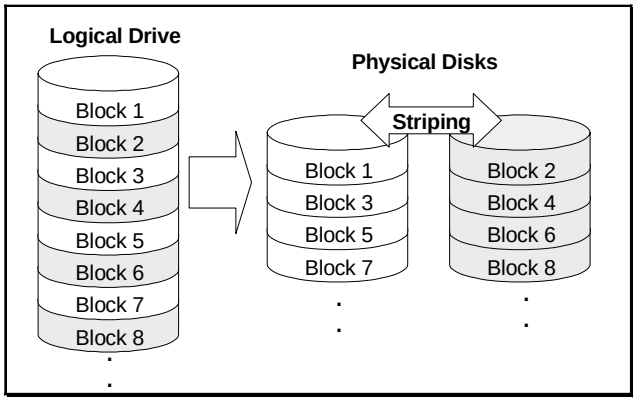
RAID 0

RAID 0 implements *block striping* where data is broken into logical blocks and striped across several drives. Although called "RAID 0," this is not a true implementation of RAID because there is no facility for redundancy. In the event of a disk failure, data is lost.

In block striping, the total disk capacity is equivalent to the sum of the capacities of all IDE drives in the array. This combination of drives appears to the system as a single logical drive.

RAID 0 provides the highest performance without redundancy. It is fast because data can be simultaneously transferred to/from multiple disks. Furthermore, read/writes to different drives can be processed concurrently.

RAID 0



RAID 1

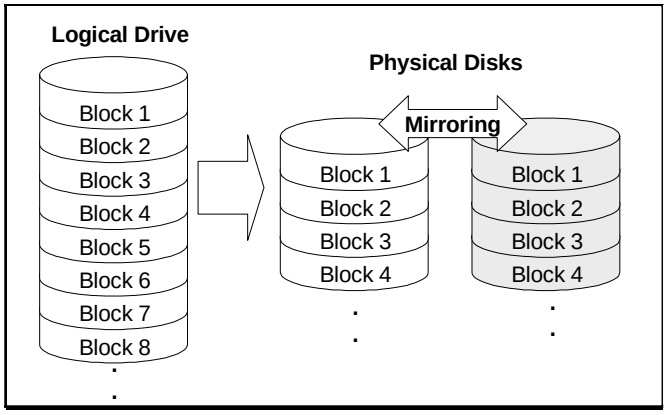
RAID 1 implements *disk mirroring* where a copy of the same data is recorded onto two sets of striped drives. By keeping two copies of data on separate disks or arrays, data is protected against a disk failure. If, at any time, a disk on either side fails, the remaining good disk (copy) can provide all of the data needed, thus preventing downtime.

In disk mirroring, the total disk capacity is equivalent to half the sum of the capacities of all IDE drives in the combination. Thus, combining four 1GB IDE drives, for example, would create a single logical drive with a total disk capacity of 2GB. This combination of drives appears to the system as a single logical drive.

NOTE:
One drawback to RAID 1 is that it does not allow running expansion. Once a RAID 1 array has been created, to expand it, the data must be backed up elsewhere before a new drive can be added. Other RAID levels permit running expansion.

RAID 1 is simple and easy to implement; however, it is more expensive as it doubles the investment required for a non-redundant disk array implementation.

RAID 1

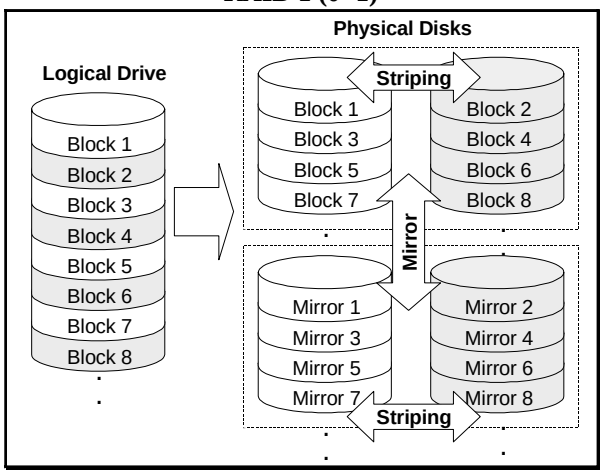


In addition to the data protection RAID 1 provides, this RAID level also improves performance. In cases where multiple concurrent I/Os are occurring, these I/Os can be distributed between disk copies, thus reducing total effective data access time.

RAID 1(0+1)

RAID 1(0+1) combines RAID 0 and RAID 1 – *mirroring and disk striping*. RAID (0+1) allows multiple drive failure because of the full redundancy of the hard disk drives. If more than two hard disk drives are chosen for RAID 1, RAID (0+1) will be performed automatically.

RAID 1 (0+1)



IMPORTANT:
RAID (0+1) will not appear in the list of RAID levels supported by the controller. If you wish to perform RAID 1, the controller will determine whether to perform RAID 1 or RAID (0+1). This will depend on the number of drives selected for the logical drive.

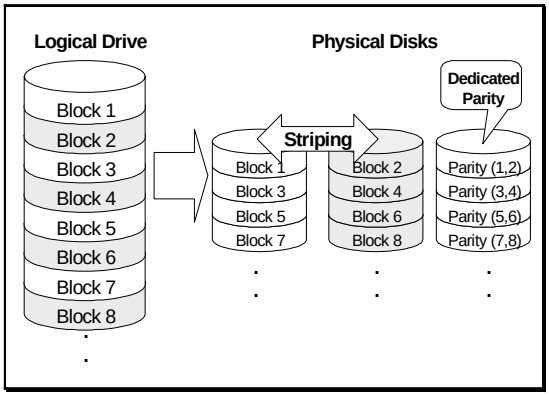
RAID 3

RAID 3 implements *block striping with dedicated parity*. This RAID level breaks data into logical blocks, the size of a IDE disk block, and then stripes these blocks across several drives. One drive is dedicated to parity. In the event a disk fails, the original data can be reconstructed from the parity information.

In RAID 3, the total disk capacity is equivalent to the sum of the capacities of all IDE drives in the combination, excluding the parity drive. Thus, combining four 1GB IDE drives, for example, would create a single logical drive with a total disk capacity of 3GB. This combination appears to the system as a single logical drive.

RAID 3 provides increased data transfer rates when data is being accessed in large chunks or sequentially. However, in write operations that do not span multiple drives, performance is reduced since the information stored in the parity drive needs to be re-calculated and re-written every time new data is written to any of the data disks.

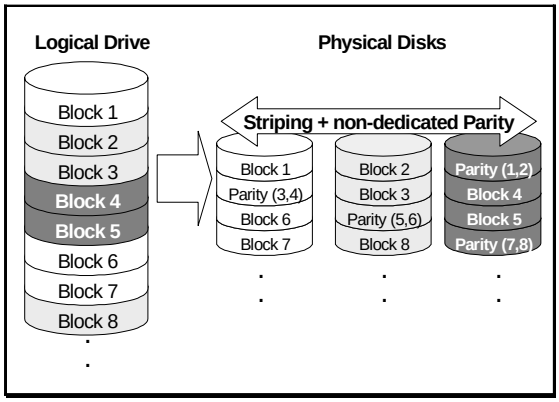
RAID 3



RAID 5

RAID 5 implements *multiple-block striping with distributed parity.* This RAID level offers the same redundancy available in RAID 3; though the parity information this time is distributed across all disks in the array. Data and relative parity are never stored on the same disk. In the event a disk fails, original data can be reconstructed using the available parity information.

RAID 5



RAID 5 offers increased data transfer rates when data is accessed in large chunks (i.e., sequentially) and reduced data access time for many simultaneous I/O's when they do not span more than one drive.

Spares

RAID implementations include one other basic concept that needs to be introduced at this point: spare drives. RAID levels 1, 3, and 5 all allow users to include a drive as a "spare." Spare drives are installed, fully functioning, "hot-ready" hard drives which a RAID controller will use to replace a failed drive as soon as the failure is detected. The purpose of this, obviously, is to enhance the existing fault-tolerant capabilities of a RAID array. Spare drive implementations will be discussed in greater detail in later chapters.

1.2 Product Elements

The IFT-6300 consists of a RAID controller (SCSI-to-IDE or Fibre-to-IDE); eight IDE drive bays and trays; redundant, hot-swappable power supplies; redundant, hot-swappable fans; and a rackmount enclosure to integrate all of these separate pieces.

RAID Controller

The controller, whether SCSI-to-IDE or Fibre-to-IDE, used in the IFT-6300 is the central element of the product. A RAID controller is, essentially, a sophisticated computer that manages data flow to and from array hard drives in the most fault-tolerant manner available. The RAID controller used in the IFT-6300 supports RAID levels 0, 1(0+1), 3, and 5; and provides various user interfaces for system management and monitoring.

IDE Drive Bays and Trays

Drive bays are the spaces provided in the IFT-6300 enclosure for hard drives. Trays are containers where drives are mounted and which permit hot-swapping. The bays and trays in the product are designed for industry-standard 3.5" x 1" high EIDE hard drives.

Power Supplies

The product comes standard with two redundant, hot-swappable power supplies. Both power supplies provide power to the product simultaneously and each is capable of supplying power to the product alone if necessary. Note that extended single-power supply operation is not recommended and should only take place in the event of a power supply failure.

Enclosure Fans

The product comes standard with two redundant, hot-swappable enclosure fans. Both fans provide airflow to the product simultaneously and each can operate independently if necessary. Note that extended single-fan operation is not recommended and should only be used in the event of a fan failure.

Enclosure

The “box” which contains the controller, drives/drive trays and bays, power supplies, and fans is called an “enclosure.” The enclosure includes various controls, ports, and other features used to connect the IFT-6300 to a host for example. The enclosure controls and ports will be described in detail later in this document.

1.3 Product Features

- Ultra2 SCSI host interface, up to 80Mbyte/sec transfer rate
  OR
- Ultra160 SCSI host interface, up to 160Mbyte/sec transfer rate
  OR
- FC-AL Fibre Channel host interface, up to 100Mbytes/sec transfer rate

- PowerPC 603e 100MHz CPU
- 32MB SDRAM SODIMM cache memory
- Two independent 33MHz 32/64-bit PCI buses
- Easily upgraded Flash ROM for firmware
- Space for up to 8 EIDE ATA-66/UDMA-66 (ATA/UDMA-100 applicable) hard disk drives
- Supports 3.5" x 1" high EIDE drives
- RAID levels: 0, 1(0+1), 3, 5
- Smooth hot-swappable drive tray mechanism
- Auto RAID Setup provides easy installation
- User-friendly RAIDGuide GUI RAID manager
- Convenient front LCD control panel
- Two redundant, hot-swappable power supplies
- Two independent, hot-swappable cooling fans
- Compact enclosure