



# **RAID Adapters: The Basics**

## **University Training Module**

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## Introduction

Before you begin learning about specific Adaptec products and solutions, make sure you are familiar with the basics. This module introduces you to RAID adapters.

At the completion of this module, you should be able to:

- Explain what a RAID adapter is.
- List the reasons why RAID and RAID adapters are important in data storage.
- Describe the functions of a RAID adapter.
- Understand the difference between a RAID adapter and a host bus adapter.
- List some applications for a RAID adapter.
- Understand when to use a RAID adapter, and when you could use a host bus adapter instead.

## What is RAID?

Before we talk about RAID adapters, let's quickly review RAID technology.

RAID stands for Redundant Array of Independent Disks and is a method of treating several individual disk drives as one logical unit (RAID array or logical drive) to improve security, reliability, and read and write performance.

RAID protects data and improves system performance by copying or spreading the same data over multiple drives. Data can be mirrored (duplicated on multiple drives), or striped (spread over multiple disks), or both, depending on the RAID level. If one of the drives in a logical drive fails, the data that's stored on it can be reconstructed on a replacement drive, keeping data safe and available for users.

**Note:** A logical drive built with RAID 6 or RAID 60 can recover from two simultaneous drive failures.

Eight RAID levels (0, 1, 1E, 5, 6, 10, 50, 60) provide varying levels of performance and reliability based on the number of disk drives in the array.

**Note:** Read more about RAID in the Adaptec University Training Module, *RAID: The Basics*.

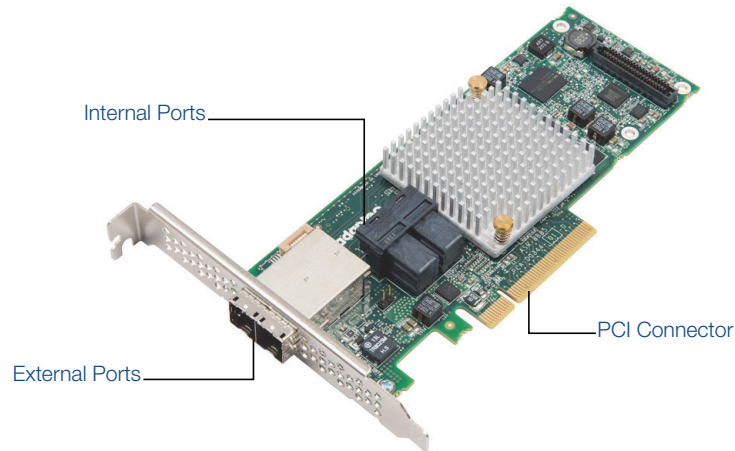
## Why is RAID Important?

RAID can make drives:

- **Bigger.** Combining the capacities of multiple physical drives creates a single, large logical drive.
- **Faster.** Combining the performance of individual physical drives, the logical drive can be much faster than a single physical disk.
- **Safer.** Using complex mathematics, a logical drive is able to safeguard data against a physical drive failure, and can recreate the missing data on the fly from the other physical drives in the logical drive.

## What is a RAID Adapter?

A RAID adapter is a circuit board or expansion card that is installed in a PCI slot on the host system motherboard and then connected with compatible cables to storage devices that are either internal — hard disk drives (HDDs) and/or Solid State drives (SSDs)—or external—storage enclosures such as JBODs.



A RAID adapter sits in the center of the input/output (I/O) path, communicating data from the host system to the storage devices and vice versa, taking on the tasks of storing and retrieving data that are otherwise done by the host system's microprocessor (CPU). It does not rely on the host system for resources, instead freeing up the CPU to run applications.

Logical drives connected to a RAID adapter can be used to either boot the system, store data, or both, creating redundancy and improving performance across the storage system.

RAID adapters support specific types of devices, such as Serial ATA (SATA), Serial Attached SCSI (SAS), and Fiber Channel. Not all RAID adapters support all types of devices.

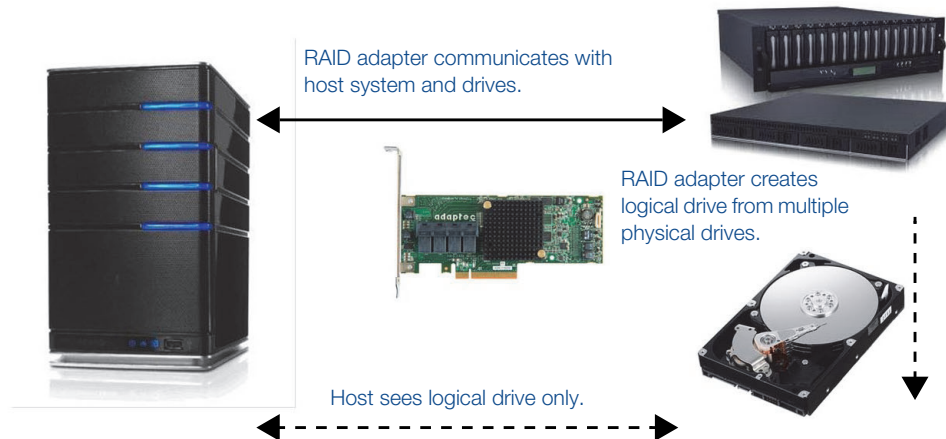
**Note:** Adaptec RAID adapters simultaneously support HDDs and SSDs in both SAS and SATA interfaces on one adapter.

## What Does a RAID Adapter Do?

A RAID adapter provides hardware-based RAID to a storage system.

**Note:** Some motherboards have host-based RAID adapters built in, where the RAID chip provides basic RAID function but the I/O relies on the host CPU. Additionally, some operating systems have built-in software-based RAID. Neither of these two types of RAID applications have the performance or functionality of hardware-based RAID from Adaptec.

A RAID adapter combines the drives connected to it into virtual or logical drives. The operating system then sees each logical drive (in reality, at least two physical devices) as a single physical drive.



Each logical drive that the RAID adapter creates has data protection built into it in the form of a RAID level. The level of RAID assigned to an individual logical drive depends on the number of physical drives included (some RAID levels require minimum and/or maximum numbers of drives) and whether system performance or data security is the priority.

A RAID adapter also uses its built-in cache to improve read and write performance.

## Why is a RAID Adapter Important?

Adding a RAID adapter to a storage system is important because:

- RAID protects against data loss and provides real-time data recovery when a disk drive fails, reducing system downtime.
- Multiple drives working together offer better read and write performance than a single drive or group of independent drives.
- Multiple drives combined together can be used to make a very large drive, which gives a system administrator much better control over data storage practices and greatly reduces the wasted space in storage systems.

## What is the Difference Between a RAID Adapter and an HBA?

A RAID adapter is an add-in card that takes the physical devices connected to it and turns them into logical drives, which the operating system then sees as single physical drives.

A RAID adapter provides data security, storing the same data across multiple drives by either striping or mirroring.

A RAID adapter improves read and write performance by using its built-in cache.

A RAID adapter can create a drive that's larger than any single physical disk.

A host bus adapter (or HBA), on the other hand, is an add-in card that allows a host system and connected storage devices to communicate with each other. An HBA provides no redundancy or data protection, does not have any cache to manipulate data with, and cannot join drives together to make larger drives. An HBA relies on the speed of the individual devices connected to it for its performance.

**Note:** Read more about HBAs in the Adaptec University Training Module, *Host Bus Adapters (HBAs): The Basics*.

## Where are RAID Adapters Used?

RAID adapters can reliably connect hundreds of HDDs, SSDs, tape drives, and external storage enclosures to the host system, making them ideal for all levels of servers—from entry-level 2- or 4-drive systems, right up to 72-drive data center surveillance machines.

When connected to the right drives, and using an appropriate RAID level, a RAID adapter works well in any of these environments:

- General file server
- Database server
- I/O-intensive storage applications
- Network attached storage
- Web servers
- Cloud environments

## When to Use a RAID Adapter

Use a RAID adapter in situations where you need to add RAID protection against drive failure.

Use a RAID adapter when:

- Your systems are running standard off-the-shelf software, such as Windows or Linux.
- If you plan to connect a JBOD (as opposed to an RBOD), because a JBOD has no built-in data protection.

## When Not to Use a RAID Adapter

RAID adapters are more expensive than HBAs, so you might want to use an HBA instead of a RAID adapter in situations where you don't need RAID protection against drive failure.

You could use an HBA when:

- The device you are connecting to is not a disk device (for example, a tape drive).
- The device you are connecting to provides its own RAID (for example, an external storage enclosure such as an RBOD, or RAID Bunch of Disks).
- Software provides data protection (for instance, in large data centers).

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