

Technical Brief

Infotrend

Introducing High-reliability 2.5” Hard Drives into External RAID Storage

Abstract

2.5-inch disk drives have potentials in enterprise external storage by its compact size, high reliability, and performance density. Another promising sight is that the cost per gigabyte between 3.5-inch and 2.5-inch disk drives has been drawn near.

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2.5" hard drives deliver higher performance and lower power consumption, making it ideal for high density RAID applications

You can double the number of spindles within the same footprint using 2.5" disk drives

Traditionally, the small form factor (SFF) 2.5-inch hard drives have been considered as "mobile" or "laptop" drives because of their prevailing presence in laptop PCs. Drive manufacturers now look to the potentials of using 2.5-inch drives in enterprise storage by drawing near the cost per gigabyte between 3.5-inch and 2.5-inch hard drives. In various aspects, 2.5-inch hard drives deliver higher performance and lower power consumption, yet in a much smaller form factor, making it ideal for high density RAID applications.

As the oil price per barrel is approaching \$100, the call for an energy-saving and cost reduction solution can only become more desperate. Considering the cost per square foot for building a data center can exceed \$1000¹, you can double the number of disk drives within the same footprint using 2.5-inch disk drives. Efficiency is also increased by having more actuators for the same amount of capacity.

There are several benefits applying 2.5-inch disk drives in external RAID arrays:



Infotrend B12S/B12F 1U RAID Enclosure

Cost Reduction

1. Compact in Size:

SFF 2.5-inch disk drives are simply smaller than their 3.5-inch counterparts. That means more disk drives can be integrated in the disk array enclosures. For example, an Infotrend's B12S/B12F 1U enclosure houses 12 2.5-inch SAS disk drives while the same number of 3.5-inch disk drives requires a

1. Estimated cost per square foot from IDC.

2.5" disk drives consume 45% less power than their 3.5" counterparts

2U-profile enclosure. This density edge dramatically improves space utilization efficiency.

2. Power Consumption and Heat Generation: SFF 2.5-inch disk drives consume 45% less power than their 3.5-inch counterparts. They run cooler with reduced airflow requirements, which also decrease the chance of encountering thermal issues and the cost on providing airflow ventilation.

Better Performance

Hard drive performance is measured in the following ways:

1. Transactional performance: The transactional performance is the measurement of the number of individual I/O commands that can be processed in a second (I/O per second).
2. Sequential performance: The sequential performance is the measurement of the amount of data that can be delivered in a second (MB per second).

2.5" disk drives are inherently faster in terms of seek times (15% faster) than 3.5" disk drives with the same rotation speed

2.5-inch 15,000RPM disk drives are inherently faster in terms of seek times (15 percent faster) than 3.5-inch disk drives with the same rotation speed. The sustained transfer rate of a 2.5-inch drive is approximately 70 to 112MB/s, very similar to that of a 3.5-inch counterpart. For an external RAID, more spindles mean greater IOPS. By doubling the spindle density, e.g., 12 3.5-inch HDD versus 24 2.5-inch HDD in the same 2U rack space, performance is improved especially for I/O-intensive applications.

Higher Reliability

1. Higher MTBF:
High-end 15,000RPM 2.5-inch SAS drives feature a 1.6

High-end 2.5" SAS drives feature a 1.6 million hour MTBF, which is 15% higher than the 1.4 million hour by 3.5" disk drives

In a high-transaction rate and random-access environment with intensive seek operations, the potential performance loss can be mended by 2.5" disk drives

Though the cost of 2.5-inch drives is higher than that of the 3.5-inch counterparts, the 2.5-inch configuration delivers twice the spindles and throughput in the same enclosure space.

million hour MTBF, which is 15 percent higher than the 1.4 million hour by 3.5-inch disk drives.

2. Shock Tolerance:

Shorter and stiffer actuator, smaller discs, and a compact motor increases its tolerance to shock and vibration, and hence more reliable in operation.

3. Less Vibration When Spinning

Spinning multiple drives in a RAID enclosure can introduce interference from the seek acceleration by one drive seeking data to another that is writing. The transmitted vibration can cause retries and hence the overall array performance can be affected. In a high-transaction rate and random-access environment with intensive seek operations, the potential performance loss can be mended by 2.5-inch disk drives. 2.5-inch drives do not generate sufficient vibration during seeks to degrade the overall performance.

By combining the advantages described above, 2.5-inch drives can be a better choice in the external RAID applications.

Implementation Concerns Using 2.5-inch Disk Drives

Having mentioned the advantages of 2.5-inch disk drives, the scrupulous reader of this article may ask: "Is there any trade-off using 2.5-ch disk drives?"

Yes, 2.5-inch drives are smaller in capacity. The cost per gigabyte of 2.5-inch 15,000RPM drives is still higher than that for the 3.5-inch counterparts. This can deter customers from the implementation due to the budget concern. However, for 2.5-inch 10,000RPM drives, the cost per gigabyte is almost the same or even lower than

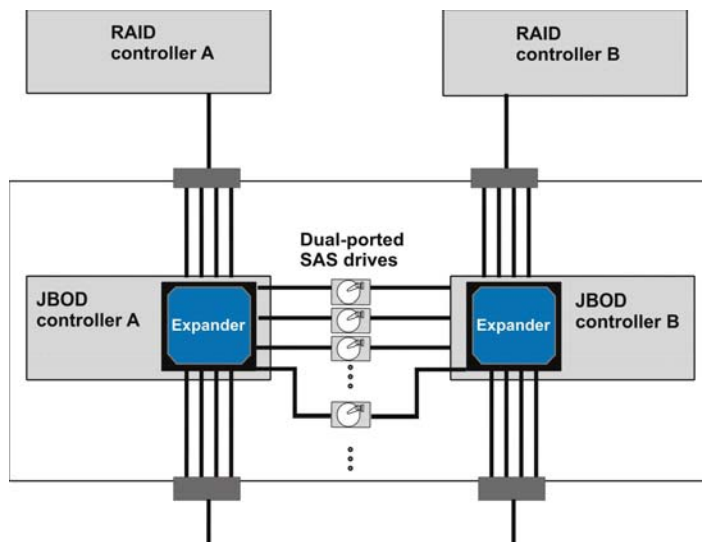
the 3.5-inch 15,000RPM drives, surpassed by only a small performance margin.

The comparison can be exemplified by picturing a 2U rack space where you can install 12 3.5-inch 15,000RPM, 300GB SAS drives – or - 24 of 2.5-inch 10,000RPM, 146GB drives. The capacity, cost, and power consumption factors are almost identical, but the 2.5-inch configuration delivers twice the spindles and throughput using the same enclosure space. Reliability is also higher as previously described.

Infotrend Solution

Being small yet full-featured, the EonStor B12S and B12F series boasts the highest performance-density for applications that require space efficiency and intensive I/O transaction

Infotrend implemented the advantages of 2.5-inch disk drives with sophisticated hardware and also the advantages of SAS technologies such as the ease of external cabling. SAS also allows data paths to be routed from dual-ported SAS drives, to the SAS expanders on RAID/JBOD controllers, and to the external interfaces. Data access is safe from single point of failure.



No Single Point of Failure Configuraiton

Featuring a full set of fault-tolerant hardware in a compact 1U-profile enclosure, Infotrend's B12S and



B12F RAID systems leverage the benefits of low vibration and the reduced airflow requirements of 2.5-inch drives. Being small yet full-featured, the B12S and B12F series boasts the highest performance-density for applications that require space efficiency and intensive I/O transactions.

Conclusion

Today's enterprises are facing the same challenge of keeping up with data growth while containing the total cost of ownership. Power-saving and environment protection has also become an important concern. The small form factor 2.5-inch disk drives answer these demands with the advantages of power-saving and performance density features. With its more-than-sufficient reliability, 2.5-inch disk drives are about to create a trend in high-density enterprise storage.