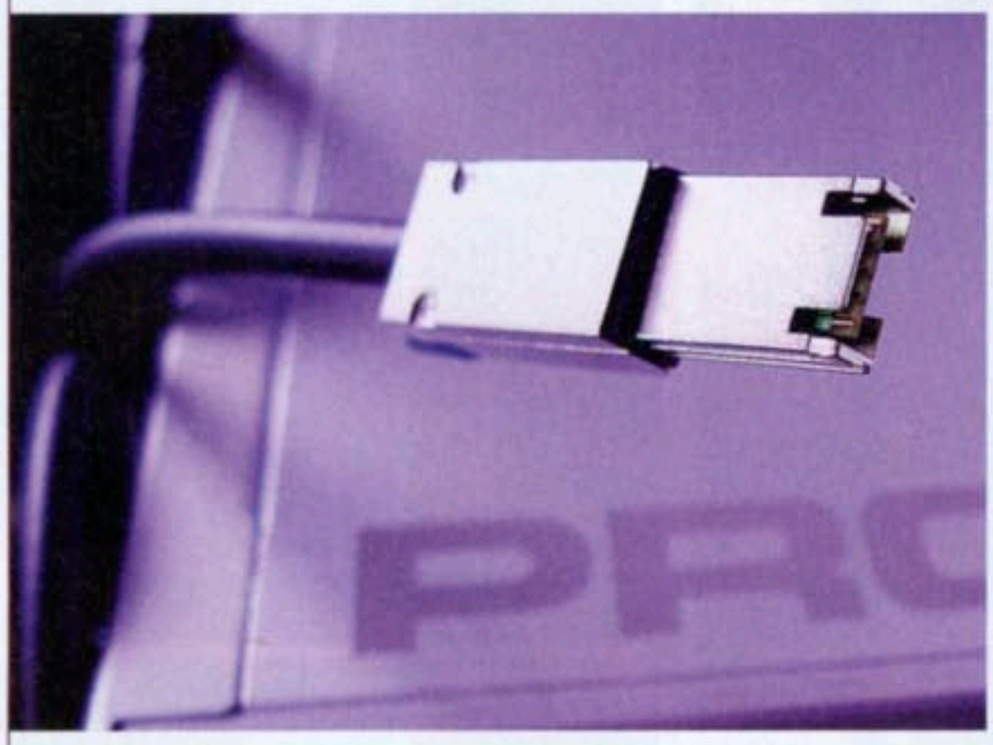
THE ULTIMATE DIY RAID



The RocketRAID 3522 card proved to the perfect heart of my Ultimate project. At right is one of its 4-channel MiniSAS Connectors.

BY NED SOLTZ

Over the past several years, I've built RAIDs, utilized several in production and reviewed turnkey systems from several major vendors. Along the way, I've learned a few things from both hard knocks and advancing technologies.

The first lesson is redundancy. The question is never whether a hard drive will fail, but *when* it will fail. I've learned that hardware-based RAID controllers are superior to software-only RAIDs. A software-based RAID places additional load upon the host computer's CPU for processing, is potentially more vulnerable to host computer failures and can only function in a write-through mode for less data protection. Hardware-based RAIDs employ chipsets that effectively make the RAID independent of the host computer. For video purposes, where maximum error correction and fastest read/write times are critical, hardware-based RAIDs can employ a write-back cache for data protection and their independent processors handle the *i/o* tasks as well as drive maintenance and rebuilding the RAID in case of drive failure.

And now, before I even proceed to the specifics of the Ultimate RAID, I offer you the ultimate caveat: I have tested and reviewed RAIDs from 3ware, Dulce Systems and CalDigit. All offer amazing performance. I could equal that performance with my Ultimate RAID and at a lower price. But in a professional environment, time and convenience are worth money. Think of saving money on a RAID but losing money in downtime when dealing with multiple vendors. Hmmm.... Was it the card, the drive or the enclosure that failed? Where is the receipt for those drives? What do you mean that *boxpusher dot-com* says I need to replace the defective drive through the drive manufacturer? In short, the peace of mind of single-vendor support that delivers a properly formatted, configured and drive-matched RAID is "priceless."

Now that I've told you that cheaper isn't always better, let's save money and learn about RAID technology by combining some of the top products on the market.

THE CONTROLLER CARD

The RAID controller card is the heart of the system. A hardware-based controller card must be able to support whatever level of RAID protection you desire. Most frequently utilized in video applications are either RAID 5 or RAID 6. These levels of RAID write parity across all of the devices in the array and have the option for a hot spare. RAID 5 allows for one drive failure and RAID 6 allows two drive failures. The controller card should have options for battery backup to complete an *i/o* operation in event of host computer power failure, remote notification, rebuilding options and remote control options.

These features and more are found in the RocketRAID 3522 ($560), an 8x PCIe 1.0 card that works in any PC or Mac with PCIe slots. Note that in a MacPro (early 2008), it will work at 4x speeds in either of the 4x slots but will only work a 1x speed in the 16x slot (which only supports PCIe 2.0 cards at full speed). I tested the card in a MacPro (early 2008), dual 3.2 with 14GB RAM running OS 10.5.

The RocketRAID has an optional battery backup as well as an Ethernet port. This port allows remote administration of the RAID and was very useful when I ran into some configuration issues when first setting up the RAID. Highpoint Tech Support was able to see my RAID over the Internet via VPN and diagnose that the first card Highpoint had sent me was defective. A new card arrived in a matter of days. Highpoint gets very high marks in tech support.

Central to the card is the Intel IOP 81341 processor, which offloads all RAID activities, reads and writes from the computer's CPU and sequences those *i/o* operations to achieve fastest possible speeds. The card contains two 4-channel MiniSAS connectors which lock into the card, making this connection much more

secure than eSATA connectors. With each channel being independent, there is not any loss of speed as occurs in port-multiplied SATA configurations.

The RocketRAID 3522 is administered on the host (or remote) computer via a browser-based GUI. Setup takes some careful attention. After logging into the management features, initialize the drives within the RocketRAID interface (not the host OS), designate the drives you wish to include in the RAID, specify a RAID level and specify write-through or write-back cache options. Write-back cache will slow down transfers but provide more protection.

I tested the card with the Enhance E8-MS enclosure to be described below, first with eight Seagate 1TB drives and then with Samsung Spinpoint F1 1TB drives. In both cases, I chose RAID 5 with no hot spare. That essentially would result in the loss of drive capacity with the parity being written across all eight drives. I also chose to squeeze every bit of speed out of the array by specifying a write-through rather than a write-back cache.

Once that policy is specified, it is time to build the RAID. And here is where I learned a major lesson. There is an option to intialize in the foreground or background. The initialization process checks every sector on every drive. Initializing in the background makes the RAID available immediately, but the initialization process slows down throughput to the extent that it is not usable.

The first initialization I did was background. Initialization took 36 hours. I tried again, this time using foreground initialization. It took a little under 3 hours. Once initialization is compete, it is necessary to return to the host OS's disk management utility to partition and then mount the RAID. In the case of Mac OS, this is accomplished in Apple's Disk Utility.

It was now time to test. First up were the Seagate drives. Using the AJA System Test utility, I tested 10-bit uncompressed read/write and achieved the amazing rates of 537.1MB/s write and 635.7MB/s read. This would be more than sufficient to support not only 10-bit HD, but even 2K. The Samsung drives were not as fast as the Seagates, returning write speeds of 462.1MB/s and read speeds of 571.6MB/s. Now these speeds are not exactly shabby.

For real-world tests, I kept the Samsung drives in the enclosure. Over two months of testing gave me trouble-free and dropped-frame-free video in Apple Final Cut Studio 2 and Adobe After Effects CS3. I captured uncompressed 10-bit HD live from the SDI output of a Sony EX1 camera through a Blackmagic Design Decklink Multibridge Pro system. The Decklink performed flawlessly in Final Cut Pro and nary a frame was dropped. And I achieved up to six layers of 10-bit HD footage in Final Cut Pro before needing to render. Whatever I threw at this system worked.

Much of the credit for this RAID's smooth operation must go to the RocketRAID 3522. And it gets even more credit when the inevitable occurred. I noted a blinking light on my enclosure and went into the browser GUI. (I had not set any e-mail notifications in the software). The RocketRAID software showed a failure of drive two. But it also showed that the RAID had rebuilt and was running on seven drives. No data was lost, and while I did not test throughput, I did test uncompressed capturing via SDI. The seven drives were able to handle the throughput adequately. Catastrophe was avoided, and that is exactly the reason why — particularly in this tapeless age — we need redundant RAIDs.

THE ENCLOSURE


The Enhance enclosure, fully loaded.

Enhance Technology manufactures a range of enclosures from desktop to enterprise level and partners with a number of card vendors. I chose the E8-MS Proavio enclosure for this test because this new device supports either SATA or SAS drives, it is a plug-and-play solution, it has the option of a redundant power supply, it is quiet and its 4-channel miniSAS connectors are more secure than eSATA connectors. But most important, at $650 including cables, it represented an excellent value.

While some enclosures are tray-less and just allow inserting a bare drive, the Enhance E8-MS does require attaching the drive to the tray and then inserting the drive into a locking slot in the enclosure. It is a little less convenient, but in reality, how many times would one actually be replacing a drive. It took me just a little over a minute to attach a drive to the carrier.

And while we're on the topic of changing drives, another important plus for the RocketRAID 3522 paired with this enclosure is that the drives can be replaced in any sequence and the RocketRAID's processor will figure out the revised configuration.

THE BOTTOM LINE

Creating my Ultimate RAID did represent a financial savings over purchasing a pre-configured unit. Pre-built hardware RAIDs could run about $1,000 per terabyte. The RocketRAID card lists at $560; the Enhance E8-MS Proavio is $650. The 1TB Seagate drives were $250 each. That's a total of $3,210.

The combination of the Decklink MultiBridge Pro and the RAID as constructed provide me more power than I need, and my brush with disaster left me confident that data is secure. Physical construction was a snap. Configuration of the RAID required a bit of learning and attention. Management features require a learning curve, but this would be the case as well in a turnkey system since all will utilize a similar browser-based configuration to the RocketRAID.

This is the last RAID I'm going to build (for a while) since I've finally built the *Ultimate* RAID. DV