Thanks to recent advances in data storage driven by the commercial multimedia market, PC-based industrial testing is now much easier. With storage area networks, you can share and analyze your data online, avoiding the bottlenecks caused by hardwired approaches.

Storage Area Networks:
Increasing Testing Efficiency by Simplifying Data Sharing

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Ideally, an industrial test instrumentation system would offer several important features:

- Real-time verification of data storage during testing (read-after-write data verification)
- Real-time verification of data validity during testing (online analysis of recorded data by multiple workstations)
- Real-time monitoring of test results from remote locations (high-speed Internet linkage to remote sites)

The recent development of storage area networks (SANs) means that such features are not only desirable, but also practical (see Photo 1). A SAN is a high-speed, special-purpose network (or subnetwork) that interconnects different kinds of data storage devices, combining them into a single manageable data server for the benefit of a larger network of users. Essentially, a SAN gives multiple processors simultaneous access to the same data files. SANs support the interconnectivity of servers, clients, disk storage (RAID—redundant array of independent disks—or non-RAID), and CD/DVD/tape storage libraries while also providing a high level of availability, performance, and interplatform communication.

A SAN is usually located close to other computing resources but may also be extended to remote locations for backup and archival storage by using wide area network (WAN) carrier technologies, such as asynchronous transfer mode or synchronous optical networks. The common thread among SAN offerings is the transparent operation of the resulting virtual storage device, which appears to network users as a single data source without concern as to location, configuration, or interaction with other clients accessing the same resource.

Although some of these features have been offered as part of dedicated instrumentation systems in the past, PC-based instru-

Photo 1. Using Storage Area Networks (SANs) for instrumentation data allows real-time access to sensor data across network nodes. No longer must you pack a control room with test engineers glued to dedicated monitor screens. With the advent of Gigabit Ethernet, wireless LANs, and super computer strength in notebook-sized packages, the goal of distributed processing of shared data is becoming a reality in modern test cells. Although this article focuses on the advantages of SAN topology, the benefits of leveraging commercial off-the-shelf (COTS) products into test instrumentation are much broader.

mentation did not support them. With SAN technology, commercial hardware can now handle the parsing of data among applications that use standard file structures. Once the SAN software has been loaded onto the data server, disk caches and high-speed switches eliminate the two-way bottleneck of hardwired approaches (see Figure 1). Each instrumentation application has the same direct access to information as if it had its own data source; neither the physical location of the data drive nor collisions caused by multiple program access to the same file are of concern. All the overhead is handled in the background by the SAN software. (If you're interested in more of the implementation details, I suggest the Storage Network Industry Association Web site at www.snia.com or vendor Web sites, such as www.tivioli.com, www.veritas.com, or www.sms.com, all of which include technical application notes in the form of white papers.) Maintaining a modular, systemwide architecture allows the integration of technological advances and existing instrumentation without redesigning component interfaces or rewiring test facilities.

Implementing new commercial-off-the-shelf (COTS) technology requires distributing test instrumentation across a network. Specific requirements—such as the physical location of test components, redundancy, data security, and system-wide bandwidth—will differ for each test facility, but every site must be able to satisfy current test requirements while maintaining the ability to reconfigure or add capabilities for future needs. Data links can be as simple as Internet Protocol over Ethernet or as advanced as secure local area networks (LANs) using dedicated fiber channel switches. Data processing capability might range from EXCEL spreadsheets running on office computers to dedicated workstations running custom applications.

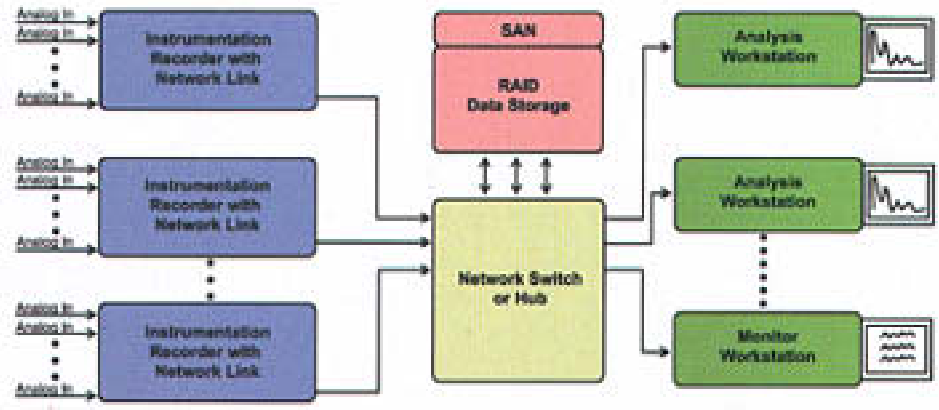

Figure 1. The sharing of real-time instrumentation data across a storage area network (SAN) now gives the test engineer capabilities previously found only in large dedicated systems. Real-time verification of data storage during test, online analysis of recorded data by multiple workstations, and remote monitoring of test operation over high-speed Internet links are just a few of the benefits already available with properly configured Windows NT–based systems.

Read-After-Write Data Verification

In the early days of analog instrumentation recorders, separate magnetic heads were used to store information and to retrieve information from tape. The first set of heads wrote information, and a second set read the stored information for verification and display. In this manner, the user always knew that the data had been properly stored (the output from the recorder was always data being read off the tape).

With the advent of digital recorders, the recording head configuration was changed to a single, dual-purpose head that could either write data to or read data from tape. This was less expensive than the two-head approach, but data could not both be written to and read from a tape at the same time. The resulting implementation (Figure 2, page 53) was to split the data path before storage onto the magnetic medium. This gave the appearance of instant data replay, and nobody was the wiser . . . or at least not until subsequent data analysis yielded different results from those of the initial test monitoring.

This implementation followed through to the next generation of digital recorders, when magnetic disks replaced

The DataMAX

The DataMAX Recorder from R.C. Electronics Inc. is a third-generation digital recorder with full shared-file access capability based on the Windows NT platform. With front-end signal conditioning, A/D converters, anti-alias filters, digital multiplexers with memory buffers, and applications software, the DataMAX recorder offers direct storage of high-quality signal data to network disk drives. A SNR of 92 dB with a full power bandwidth of 90 kHz (200 kHz sampling rate) provides instrumentation-quality data recording with all the benefits of an open-architecture, cost-effective, PC-based Windows NT platform.

Included as part of the DataMAX system is applications software that can be installed on remote PC platforms for the real-time monitoring and display of data immediately following storage to the network drive, a true storage area network (SAN) implementation. Optional features include full RAID (redundant array of independent disks) capability and the ability to synchronize multiple recorders for up to 1200 channels of simultaneous signal acquisition. The aggregate speed and processing power are limited only by the network selection and number of processing nodes, all of which can be upgraded to the most recent commercial off-the-shelf (COTS) offerings without replacing the front-end DataMAX recorders. □