Network-Attached Storage: Five 9s in real time

One of the most daunting obstacles to real time computing and *true high availability* is the failover process, particularly in a storage application where data must be kept up-to-date and available to any of a variety of clients. Most forms of clustering and replication software provide a failover that takes minutes, or even hours, which is unsuitable for any application that demands real-time computing. As a consequence, the intersection between the worlds of real-time computing and network-attached storage has not been as rich as it needs to be.

The major obstacles that must be surmounted in order to provide seamless network-attached storage in real time are application transparency, IP address failover, the stale file handle problem, and the lengthy unmounting/remounting processes required to keep the file systems operating properly. Application transparency is certainly desirable; the client applications should not need to be modified in order to use the storage appliance. Without IP failover, the storage appliance would be lost to the network clients in the event of a failure. Also, the process of unmounting and remounting a file system (which prevents the stale file handle problem) can take anywhere from minutes to hours to accomplish.

The ideal solution to implement on a network-attached storage device would be one that utilizes an interposing file system in the kernel. Thus, the client applications would not need to be modified, as all system calls and writes would be handled below their level of awareness. Subsecond IP failover would insure that clients could still communicate with the storage appliance, and subsecond file handle failover would insure that the client could still locate files without having to go through the file system unmounting and remounting that would invalidate the *real time* part of *real-time computing.*

One such solution is Continuous Computing's HiFile High-Availability Network-Attached Storage Device with upSuite, Continuous Computing's award-winning high-availability middleware package. It provides both transparent IP address and file handle failover, and its non-NFS Interposing File System both provides application transparency and avoids the issues surrounding unmounting/remounting file systems. At least five 9s of availability, if not more, are possible with this hardware/software combination–bringing network-attached storage solidly into the realm of real-time computing.

For more information on network-attached storage contact:

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INDUSTRY FEATURE

Real-time CompactPCI solutions burst into the railway industry

After a world-wide recognized success in the telecommunications and industrial control markets, the CompactPCI open standard has definitely gained a prominent position in the development strategy of real-time transportation systems such as railways, aircraft, road and unmanned vehicles. Wherever robust form factor designs and real-time reliable control systems are required, the CompactPCI is the right fit at the right time, confirming its role of fastest growing bus architecture since it's introduction in 1995. CompactPCI or rather the combination of the benefits of the PCI desktop architecture with the ruggedness of the Eurocard form factor, is a guarantee of high availability, reliability, low power dissipation, and ease of maintenance and upgrades, all issues that are definitely significant to the transportation industry.

The harsh railway environment mandates electronics designs to comply with the severe EN 50155 standards. The latter includes several test approvals concerning wide temperature fluctuations, radio frequency interference, highly isolated, heat and humidity in addition to being subjected to abnormal shocks and vibrations. Extended temperature (– 40° + 85° C) operations capability with no fan and no cooling as well as EMC compliant tests complete the basic requirements of the railway industry.

Providing the system to act as a real-time supervisor

Recently, a large and well known transportation firm needed a single board computer (SBC) available off the shelf, to comply with the EN 50155 standards. The SBC was required to be able to run a reliable real-time operating system for their railway applications. Based on a specially designed industrial microprocessor core created by ST Microelectronics, the new GESPAC SBC, referred to as the PCISTI processor board (see Figure 1), completely met the demanding requirements.

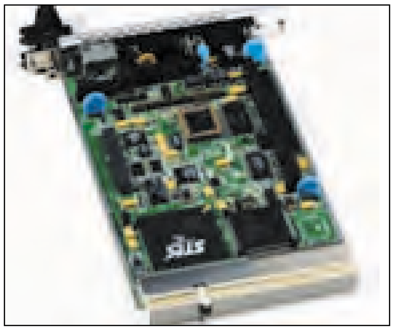

Figure 1

The new 3U product combines PC compatibility, PCI capabilities and tolerant hardened components so that it is ideally suited for fanless, rugged, low power, and extended temperature real-time applications. The on board PCI and ISA bus interfaces with:

- a VGA controller
- 32 Mbytes of DRAM
- 8 Mbytes Flash Disk
- Ethernet and RS-485/1500V isolated interfaces
- IDE and PC/104 ports

These elements complete the functionality of the 486DX onboard processor. A dedicated micro controller provides real-time system management and monitoring functions such as temperature surveillance, fan cooling, and watchdog. As a result, complete control of several DSPs and/or I/O boards is easily achievable.

Specifically, the STPC CPU board is able to act as a real-time system supervisor handling the train engine start/stop control, closing and opening the doors, and controlling the data acquisition sequence through dedicated DSP and I/O boards. The QNX® real-time operating system running on board provides dedicated software to control alarms, security checks, and procedures especially conceived for railway applications.

Surveillance system based on CompactPCI

In addition to the embedded technical solutions needed by railway applications to control and supervise real-time mechanical movements or to automatically drive unmanned train vehicles, CompactPCI is making its way into multimedia applications. Figure 2 shows a GESPAC solution for a specific railway customer's request concerning an embedded security surveillance system composed of four cameras mounted in a subway train.

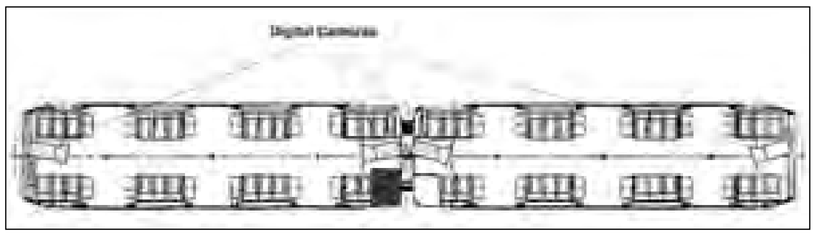

Figure 2

In a star network topology, the IEEE-1394 (FireWire) high speed plug & play 400 Mbit/sec serial bus provides the ability to control, power, and capture colour images coming from the four hot pluggable digital cameras. Only one cable per camera is needed to carry power and control signals such as focus, zoom, and luminosity. In addition, the CODEC compressing software displays a video signal while compressing and writing to storage. For instance, ten hours of video imaging can be recorded on a 10 Gbyte removable hard disk.

Figure 3 shows the scalable system architecture with its flexible topology ideally suited for digital image processing. The multimedia embedded CompactPCI system that performs the required tasks is based on the 6U PCISYS-658 GESPAC board and combines two different functional parts, as shown in Figure 4.

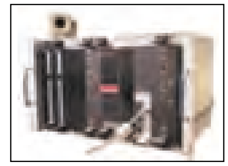

Figure 4

One CPU is dedicated to the subway train real-time control acting as described in the first part of this article running the VxWorks® RTOS. A second CPU running the Windows98 operating system is dedicated to the multimedia operations such as the video surveillance described previously or to any additional video and audio broadcasting features that might be required.

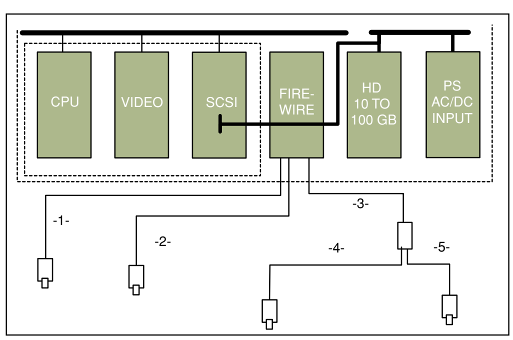

Figure 3

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Mustang Dyno uses National Instruments LabVIEW Real-Time and PXI hardware to create a powerful real-time hydraulic test system

Integrating real-time control into measurement and automation applications improves the quality of test results and performance. For instance, in an automotive test application, real-time control is required to accurately simulate road conditions. Often, companies wanting real-time performance hire specialists to program and build expensive real-time systems. While using standard software and hardware reduces reliance on contractors, traditionally, creating real-time systems exceeded the capabilities of PCs, required advanced programming techniques, and demanded in-depth knowledge of the real-time kernel.

Now, engineers can easily create powerful and flexible real-time systems with graphical development tools, such as National Instruments LabVIEW Real-Time and industry standard PXI/CompactPCI hardware. These real-time test systems deliver deterministic data acquisition and control by running test programs on an independent, embedded processor.

Engineers at Mustang Hydraulic Test Systems (HTS), a division of Mustang Dynamometer, recently created TESTCell, one of the automotive industry's first hydraulic servo test systems based on industry-standard computer technology. The system shown in Figure 1 combines the LabVIEW Real-Time graphical development environment with PXI/CompactPCI-based hardware.

Figure 1

How it works

At the core of the system, which performs closed-loop control in excess of 1,000 Hz, is the TESTCell control software. Based on LabVIEW Real-Time, TESTCell can create virtually any production line, end-of-line, or development test, such as block cycle, fatigue, and durability testing, for dampers, shocks, and other servo hydraulic components. The software includes an array of control algorithms that engineers can use to extensively define their test architecture, including specifications like sensor inputs, test limits, alarm conditions, and user interface screens. By using these controls with the TESTCell software, automotive engineers can easily create a reliable real-time test solution with a single software and hardware platform. Figure 2 shows the user interface that allows engineers to run various automotive tests.

The test platform consists of a standard desktop running the TESTCell user interface. Ethernet connects this computer to a headless PXI system that is running a real-time operating system. First, engineers develop test routines using TESTCell on a host computer. Next by selecting a simple pull-down menu, the operator downloads programs via Ethernet to a PXI system using LabVIEW Real-Time technology. The operator interface runs on the host computer while the test routine and control algorithms run independently on a processor embedded on the PXI system, ensuring reliable, deterministic control of the test routines.

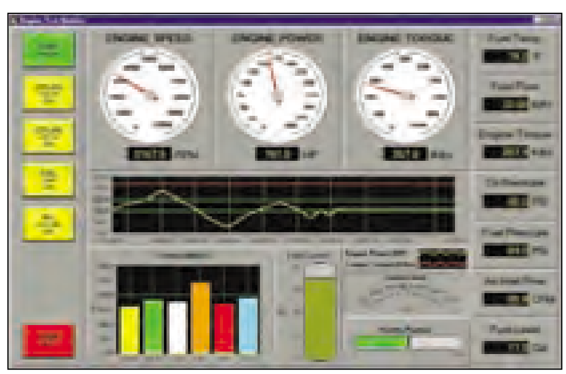

Figure 2

What makes it work

With the LabVIEW Real-Time-based TESTCell and PXI platform engineers can choose from two different systems to fit their performance requirements. The first system includes the National Instruments PXI-8156B/333 MHz RT controller, which runs control loops at 1,000 Hz, while the second system includes the Pentium-III based National Instruments PXI-8170/850 MHz RT controller, which runs at 5,000 Hz.

With the flexibility of LabVIEW Real-Time, engineers can simply transfer their software applications used with the PXI-8156B RT to the PXI-8170 RT based system for five times better performance.

The power and flexibility of the Mustang HTS system demonstrates the advantage of using tightly integrated real-time software and hardware to build a deterministic test solution that reliably responds to computer commands without delay or interruption. With the seamless integration of LabVIEW Real-Time and the open PXI standard, engineers can customize their TESTCell software to develop hundreds of different test solutions.

Customizable software runs with Real-Time performance

LabVIEW Real-Time reduces reliance on contractors, empowering engineers to build real-time systems themselves using the familiar LabVIEW graphical development environment.

LabVIEW Real-Time runs in Windows and saves engineers time in several different ways. Engineers can select functions from the wide spectrum of data acquisition, analysis, data logging, and other libraries to build a sophisticated solution such as TESTCell. By using these integrated libraries, the engineer reduces development time without sacrificing flexibility for the customer.

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INDUSTRY FEATURE

CompactPCI communications controllers to be used in mobility services

After competing in a request for proposal process, Interphase Corporation was selected by a global supplier of systems and software for next-generation communications networks to deliver the 6535 CompactPCI T1/E1/J1 Communications Controller shown in Figure 1 for the deployment of 3G wireless services. This new infrastructure is in response to demand for faster, more reliable service, flexibility and hot swap capabilities, as well as end user demand for mobile voice, data, and Internet services. The converged wireless infrastructure will allow users to send and receive mobile emails and instant messages, access the Internet, and download multi-media files. A whole new range of mobility services is based on location, which incorporates the use of wireless, Internet, and the global positioning system (GPS) to locate the user for services such as:

- 911 emergencies
- maps and interactive directions
- information on commercial venues in the area
- locate and alert friends nearby
- other innovative options

What makes it work

A challenge has been presented as voice and high-speed data services are emerging in the wireless industry and existing land-lines have been unable to satisfy consumer demand. To respond, the equipment provider put out a request for proposals to develop an infrastructure in conjunction with their existing cellular network making necessary modifications and upgrades. As a result of the proposals, the upgrades will include CompactPCI for its standards-based, high-availability performance and T1 line terminations to interface with the Intelligent Network. The new distributed architecture will exchange data and voice traffic by way of SS7 over T1 signaling messages. The Interphase 6535 Communications Controller will share the transmissions to be manipulated and distributed over the entire network and process them at a faster rate while off loading CPU processing and increasing quality of service. The communications controllers will be used in conjunction with Sun Microsystems' CT400 and CT800 CompactPCI chassis, the CP1500 CPU, SS7 protocol stacks, and the Solaris SPARC architecture. As a result, the equipment provider will have enhanced voice, data and Internet capabilities in a wireless environment, a faster time to market, a decrease in development costs, and a more extensive menu of options to offer service providers.

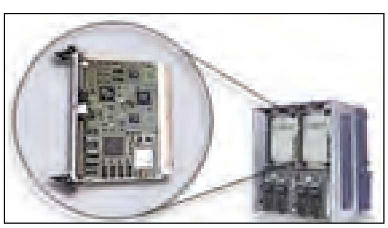

Figure 1

How it works

An example of the new mobility services in a real world application involves the use of 911 emergency services. For this purpose, the new infrastructure will combine information from the mobile phone, the GPS, and the Advanced Intelligent Network (AIN) to identify and locate a person in distress. With the new service, a person in an emergency will be able to call 911 from any location. The call and GPS coordinates will be transmitted to the nearest enhanced 911 server equipped with the CompactPCI chassis and 6535 controller. The server will process the information and send the location of the caller and ID information across the AIN to the dispatch unit. Therefore, when a person making a 911 call cannot speak or does not know their exact location, the phone that is being used can still identify them. The attendant will then be able to relay information to the proper local emergency personnel. This service is expected to save time, and as a result, lives.

When the project is completed and rolled out later this year, equipment providers will have the opportunity to provide more competitive and innovative products to service providers. Wireless end users will also benefit from more mobile options including the ability to shop for mobile services competitively and access live information from just about anywhere.

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