Phoenix Contact is a world-leading supplier of industrial-control systems. From its inception, their Steeplechase VLC product has focused on intuitive, open architectures that integrate PC-based hardware and software from many suppliers. Steeplechase VLC provides an intuitive flowchart-based environment for developing control logic, PID control, serial communications, and motion control based on Microsoft® Windows® platforms.

Created with the mission to dramatically improve productivity in the development, deployment and operation of automated material handling and manufacturing systems, today the Steeplechase Visual Logic Controller, or VLC, is regarded as the fastest control software in the manufacturing market, achieving logic scan times as short as 200 microseconds. Operating in an environment where reliability is critical, VLC incorporates INtime software from TenAsys Corporation to combine deterministic, hard real-time control with the Windows operating system.
Taking Advantage of Windows

In searching for the optimum real-time control solution, the Steeplechase VLC designers focused on three key product requirements. One was to replace conventional hardware-based PLC with standard-grade PCs. Another was to rely on a real-time system that utilized the Windows operating system as the front end. The third was to develop a soft PLC application to move from ladder logic programming to the use of flowcharting.

“We definitely did not want to create a proprietary platform,” recalls Steeplechase Global Product Manager Jeff Fisher. “Our goal from the very beginning was to use something off-the-shelf and open.”

Phoenix Contact selected INtime as the real-time operating system for VLC because of INtime’s ability to take advantage of Windows features without compromising real-time control. Plus, TenAsys — as a Microsoft Windows Embedded Partner — has maintained a firm commitment to remain current with Windows developments.

“The fact that the TenAsys product was a solid platform was very important,” Fisher recalls. “It had a history before we started looking at it. TenAsys was proven technology.”

Proving the Case for Reliability

The INtime architecture provides unprecedented system stability and reliability, which has been a critical consideration on the factory floor, especially with the introduction of Windows-based PCs into that environment.

“When we first came to market with VLC in 1995, we were going up against products that had been used all of the Windows operations — the mouse, the disks, the graphics, all those other drivers — separate from the actual logic execution of the control of the machine,” Fisher explains. “We captured 100 percent priority. Our number one task was to run that machine. Everything else was secondary.”

Fisher says the strength of INtime software is its fundamental design and the way Steeplechase engineers have integrated it into VLC. “The way the TenAsys product does a lock-out on memory and other things is very attractive to those customers who were concerned about crashing,” he says.

The INtime kernel uses iRMX, originally developed by Intel®, to provide key functions. Unlike real-time drivers that reside within the Windows kernel, the INtime solution creates two virtual machines that run side-by-side on a single hardware platform.

Virtualization for Performance

Dividing the hardware into separate virtual machines enables real-time applications to take advantage of the address isolation features of the CPU itself. The real-time kernel uses these features to isolate each real-time process from all other real-time processes and from the Windows system. If a thread attempts to access an address outside of its virtual address space, INtime generates a fault that is handled without affecting other processes.

“The TenAsys product is extremely efficient because it does take number-one priorities very, very fast,” Fisher adds. “A lot of that has to do with the way VLC was
A Windows system running INtime has two virtual machines on a single hardware platform, insuring real-time applications always have priority over and run without interference from Windows processes.

“TenAsys has been very good to work with. The key thing with their software is that when we need an enhancement, TenAsys does it very quickly, and it always does what they say it’s going to do.”

— Jeff Fisher, Steeplechase Global Product Manager

Achieving Long-term Satisfaction

Steeplechase VLC customers uniformly require high speeds and other key efficiencies, in addition to reliability.

“Our VLC product can meet the needs of almost all of our applications, but the real benefit is that about 40 percent of our customers require a very high speed, closed-loop and some sort of motion control solution,” explains Fisher. “If somebody says, ‘Look, I’ve got to run thousands of packages a minute through this thing, or I’ve got these four motion products I’ve got to interface with and I’ve got to control them at this rate, and—above all—I’ve got to make sure this thing doesn’t crash,’ then we have VLC that satisfies all of those things.”

A brief sampling of Steeplechase VLC customers shows that VLC with the INtime RTOS meets these various requirements and is creating high levels of customer satisfaction in the process.

Engineered Products & Systems, Inc. (EPSI) of Bogart, Georgia, designs and manufactures liquid-filling systems and is known for building semi-custom machines to meet the specific needs of each customer, material and bottle configuration. EPSI uses Steeplechase VLC for controlling the filling process and machine turns. VLC communicates with high-speed data acquisition cards to monitor filling volumes and valves, achieving an output rate of 1,000 bottles a minute. EPSI credits VLC with significantly improved test and debug times as well as robustness.

DaimlerChrysler’s transmission assembly plant in Kokomo, Indiana, produces 2.6 million transmissions a year. It installed Steeplechase VLC on a new transmission line with the goal of reducing floor space, but in the process achieved the fastest-ever launch of a new assembly line at Chrysler. The Kokomo plant manager credits VLC with reducing floor space requirements on the new transmission line by 40 percent, cutting design and installation time by 12 weeks and reaching full-production status in just one-tenth the normal time.

FKI Logistix, in St. Louis, produces turnkey material-handling systems for consumer goods operations. It standardized on Steeplechase VLC for hard real-time control of high-speed material handling. FKI credits VLC with efficiently integrating machine control, servo motion and HMI functions into a single-box system while reducing by 50 percent the panel space required for a typical

written — itself a very fast product — and the TenAsys product allows us to take advantage of that speed.”
system. The entire installation of the VLC system took only eight days.

Ingersoll-Rand uses Steeplechase VLC as part of its PC-based automotive transmission assembly and testing processes. According to Ingersoll-Rand, some key benefits of incorporating VLC include greatly reduced debugging time due to the VLC system’s built-in diagnostics, reduced launch times due to reusable control programs, and reduced life-cycle costs because the systems are modular and easily reconfigurable.

Maintaining a Responsive Relationship Fisher also emphasizes that Phoenix Contact’s relationship with TenAsys — and the strength of the TenAsys ties with the evolving Windows platform — has been a factor in achieving stronger relationships with its own key customers.

“Because TenAsys has continued to develop its product and progress with it on the Microsoft platform, we’ve recently been able to sign three-year extensions to some key customer agreements on service and licensing,” he explains. “This means that Chrysler, American Axle, and FKI — some of our largest customers, as examples — want to have long-term agreements with us because we have the technology they specified and that they never want to lose. This is taking reliability and turning it into real business.”

Steeplechase engineers praise the quality of support they receive from TenAsys, according to Fisher. “TenAsys has been very good to work with,” he says. “The key thing with their software is that when we need an enhancement, TenAsys does it very quickly, and it always does what they say it’s going to do. This was a very effective working relationship as we migrated to Ethernet I/O and interfaces in the real-time product.”

He cites another benefit of the relationship, which is the fact that TenAsys focuses its expertise on INtime and the Microsoft platforms, allowing Phoenix Contact to focus on its own products.

“A key thing is that they worry about their interface into the Windows products, which means we don’t have to,” Fisher says. “So when it comes to XP or 2000 or Embedded, it’s all taken care of. Our value-added and our core competency is not the raw real-time operating system. TenAsys sends it to us in a box, we add the tools to make it transparent in the industrial automation market, and it works.”