Case Study

"Embedding a PC in the analyzer has given us the additional benefit of being able to run our development software environment directly on the target hardware."

INtime® Software Preserves Abbott* Laboratories Intellectual Property While Adding New Features to its PRISM* Blood Screening Analyzers

Moving to a new PC platform gives Abbott* access to more cost-effective hardware and up-to-date interfaces for communication and I/O while protecting existing investments.

The need to preserve prior investments in real-time software code is a defining factor influencing decisions made in embedded system design. This is particularly important for long-lifecycle applications where stringent agency certification or approval is required. The risks involved in recoding proven real-time software can be huge. Besides the significant cost of agency recertification, subtle incompatibilities can erode customer confidence and destroy chances of meeting market windows.

tenAsys®

Abbott Laboratories selected INtime® for Windows* for its blood screening analyzer to maintain software compatibility with legacy systems while enabling the addition of competitive new features to their products.

Overview

The Abbott* Labs' diagnostics division is a world-renowned supplier of instrument systems used to monitor patient health and help medical professionals diagnose and treat diseases earlier. With platforms like their PRISM* high-volume immunoassay analyzer being among the most advanced in the field, Abbott must stay on the cutting edge of technology to ensure their systems remain state of the art over extended deployment cycles.

Moving to a new platform gives Abbott the opportunity to access more cost-effective hardware and up-to-date interfaces for communication and I/O, as well as the ability to incorporate new communication protocols for interacting with external systems and adopting more sophisticated data reporting methods. However, transitioning to a new platform often requires recoding, retesting, and recertifying embedded software that controls hundreds of tasks on a system like the PRISM analyzer.

Figure 1. The Abbott Labs' PRISM* immunoassay analyzer is one of the most advanced blood screening instruments on the market. It consists of 10 racks of 28 sample tubes, and each rack can be loaded and unloaded on the fly during Sample Processing or upon completion of an 8.5-hour batch run.*

Challenge

Many of the control elements that comprise a system like the PRISM analyzer are based on embedded software that has undergone rigorous regulatory certification and safety testing—a process that can costs hundreds of thousands of dollars or more depending on the size and complexity of the codebase but instills customer confidence.
In upgrading the PRISM system, the Abbott team "needed to make sure that we didn't change the fundamental elements of the process," said Brian Murphy, PRISM Software Manager in the diagnostics division at Abbott Labs.

"There is a lot going on in the system at any given moment, and the need to maintain the integrity of each sample test is critical," said Murphy. "Our real-time software needs to manage hundreds of tasks reliably. There are tasks responsible for controlling each station of each channel, the bar code scanners (one for reagent kits and one for sample racks), the sample manager XY-table, the sample manager pipetting assembly, sample scheduling, data reduction, report generation, report printing, updating the results database, Abbott retest server and external vendor laboratory information system communication, information display, resource/reagent monitoring, heater control, event logging, cycle coordination, and quite a few more."

Solution

Deterministic software is needed to ensure all of PRISM's instrument channels remain synchronized throughout the process so reliable operation is maintained. Reliability and accurate timing are essential; even a small number of mistakes or misreads in the handling of each of the 280 samples in the machine would substantially decrease throughput.

In Abbott's older machines, Intel's iRMX86* RTOS hosted the operator interface as well as all control tasks. In the new PRISM system, machine control functions are handled by real-time tasks running on TenAsys®' INtime® for Windows*.

PRISM's new control PC is a quad-core Intel processor that connects to multiple microcontroller-based pump and motion controllers within the unit via a BITBUS interface (a simple serial master/slave communications

interface that transfers data at 375 kbps) and bar code scanners. Six different testing channels are supported: five for measurement and one for backup. The control PC sets up each channel as a separate job—or real-time application—to be managed by the INtime for Windows RTOS.

The deterministic INtime software runs partitioned on one of the PRISM control PC's Intel* processor cores while a separate Microsoft* Windows Embedded environment consumes the other three (Figure 2). This frees Abbott to incorporate new and updated operator interface features via applications running on the Windows* operating system. For example, an old menu-driven interface was replaced with a touchscreen graphic user interface (GUI).

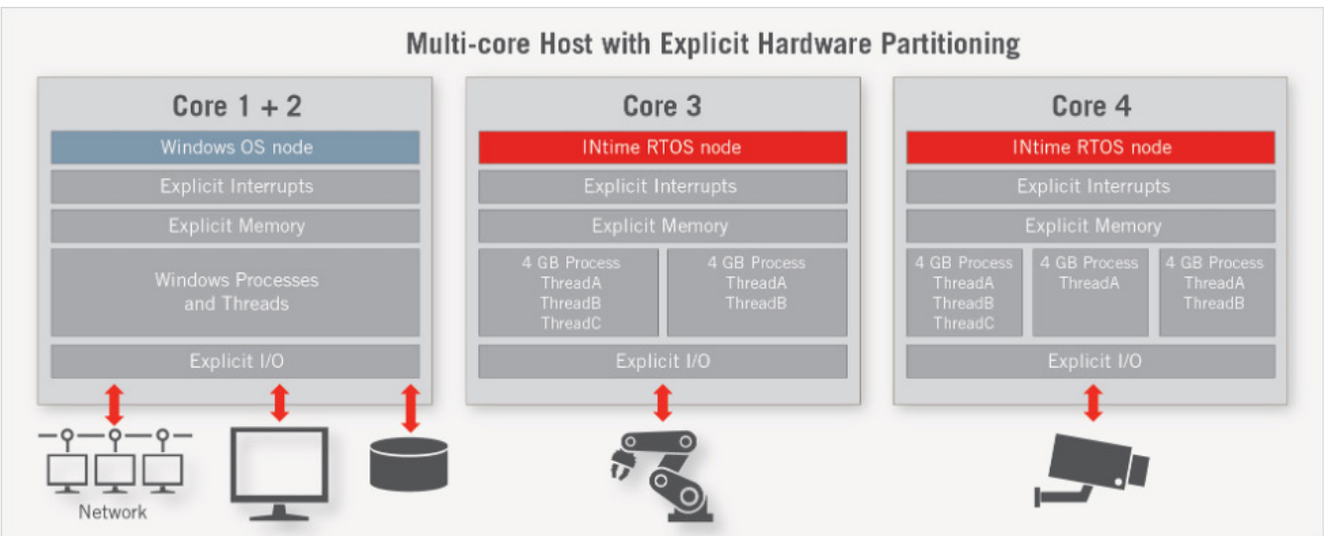

Figure 2. TenAsys® Intime® for Windows uses explicit partitioning to separate memory, I/O, and process threads that require tight deterministic control from other less-critical workloads running in Windows environments on different cores of the same physical processor.*

Meanwhile, the architecture also allows for reuse of the existing Abbott Labs IP that ensured high-throughput deterministic control, facilitated by INtime software.

"Maximizing throughput and uptime of the PRISM machines is critical," said Murphy. "In a lot of the labs that run PRISM, our customers run the machines three shifts per day for 6.5 days per week."

Results

The choice to use INtime for Windows simplified the platform transition, allowing Abbott to port their proven software with minimal changes to the RTOS environment while integrating a GPOS that can even be upgraded as new OS and tool technologies are released.

“The new Microsoft Visual Studio* Integrated Development Environment (IDE) has helped us stay up to date and perform upgrades such as going from MS Visual Studio 2005* to MS Visual Studio 2010*,” said Brian Murphy. This IP reuse-friendly approach that eases system modernization was critical to maintaining development schedules and simplifying compliance with the US Food and Drug Administration’s (FDA) strict product certification rules.

“By migrating the system processor to the latest PC hardware and software technology, we saved costs and obtained access to the latest industry-standard hardware resources,” said Murphy. “Embedding a PC in the analyzer has given us the additional benefit of being able to run our development software environment directly on the target hardware, saving development time and effort and simplifying PRISM software and hardware upgrades compared to using separate development workstations.”

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