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Embedded Review

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Accelerating the Adoption of Win32® for Embedded System Development

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The embedded systems industry is undergoing a massive transformation. Driven by the emergence of low-cost, application-specific, 32-bit microprocessors, the traditional embedded systems market can now draw upon commercial-off-the-shelf operating systems and application software. The same advantages available to desktop developers over the past few years can now be realized through the utilization of Win32® technology in an embedded system. Component-based software applications built on general-purpose operating systems will lead to shorter product development cycles, extended product life, increased product functionality, and reduced overall product costs.

Delivering on a promise to address the requirements of embedded system developers, Microsoft reset the market with the introduction of Windows® CE 1.01 last year. There is no question that Microsoft is the leader in the desktop marketplace, and now has its sights firmly set on the embedded marketplace. This ambition coupled with strong third party technology providers such as Intrinsyc Software, Inc., ring in the new "Embedded Windows" paradigm.

Embedded Market Trends

The business and technology issues for the embedded community remain the same over time. Some key issues for the developer include time-to-market, product lifecycles, increasing product functionality, maintainability/serviceability, and overall product development cost.

Product differentiation is now focused in two main development areas: special purpose hardware, such as that which might be applied to high performance multimedia applications; and application specific value-added software.

The definition of an embedded system has also changed. Black boxes designed to perform one specific task are no longer acceptable. Customers are now demanding solutions built for multiple purposes with clear upgrade and replacement paths. Graphical user interfaces, remote connectivity, data sharing, and application programming interfaces normally associated with desktop software applications, have created a compelling reason to consider Win32 the embedded operating system technology of choice now and in the future.

"Win32® solutions can improve time-to-market, overall cost, quality, and product life."

Win32 Features/Benefits

What makes Win32 so compelling to system developers? The more than one million Win32 developers will probably mention these benefits:

- Large developer community with shared interests is like having your own big virtual team;
- Low-cost, standard development tools improve productivity;
- Foundation code, drivers, and software components from Microsoft and third parties allow developers to focus on their own value-added applications;
- Component-based development provides real opportunity for code reuse and cost savings; and
- Higher quality applications lead to lower support costs.

All of these benefits impact the ability of the embedded developer to deliver product that meets the expectations of their customers.

Embedded Development Requirements

Thanks to third party software technology providers such as Intrinsyc Software, Inc., the Embedded Windows paradigm is even further enhanced. Intrinsyc recognizes that developers of embedded applications have unique requirements not faced by their desktop counterparts. Hardware resources are at a premium and system reliability and predictability are among the absolute requirements. For that reason, Intrinsyc has developed a suite of development tools and software components that leverage and add value to the Win32 embedded application developer.

Ideal Applications for Win32 Embedded Solutions

The Embedded Windows initiative is particularly attractive for new high-end embedded systems where the emphasis is on providing complex functionality not traditionally found in embedded systems. If your system requires networking to other information systems, graphical user interfaces, or integration with commercial-off-the-shelf components, then a Win32 solution is an excellent option.

While the bulk of today's embedded marketplace is associated with simple embedded controllers, the future Embedded Windows market will support a wide range of sophisticated embedded applications and systems for manufacturing automation, telecommunications, medical equipment, transportation, test and measurement, and retail/office automation. Developers of this new class of systems need to implement and deploy high-quality embedded Win32 applications and systems in a cost-effective and timely manner. Intrinsyc offers cost effective tools for embedded application devel-

opment, system configuration, and target generation that enable our customers to rapidly create and deploy embedded systems.

Microsoft's Industry Standard Development Tools

Market surveys indicate that there are approximately three million Visual Basic and two million VC++ developers. A small but growing percentage of these users will soon be developing applications for the Embedded Windows market.

Enabling tools provided by Microsoft for Windows CE 1.01 included: OEM Adaptation Kit (OAK) for OEMs; Device Driver Kit (DDK) for IHVs; and Software Development Kit (SDK) for OEMs, IHVs, and ISVs. Microsoft supplied the SDK and DDK as add-ons for Developer Studio, allowing users to build Windows CE applications and drivers much like they would for Windows® NT and Windows® 95 desk-top applications. More recently, Microsoft announced the introduction of Windows CE 2.0 toolkits for Visual Basic, Java, and VC++. In addition, they have repackaged the OAK, and will be supplying the Windows CE embedded toolkit for VC++, which includes an Embedded Development Kit (EDK) for use by OEMs and OEM partners.

Traditional embedded development tools are typically not as sophisticated or as robust as the Microsoft standard development environment. For example, the cross-compilers, assemblers, debugger samples, header files, system libraries, programming documentation, and remote tools found in Microsoft's offerings are far superior to equivalent offerings in the majority of proprietary integrated tool suites. However, traditional embedded systems development tools provide a number of key features critical to embedded development, including system modeling, resource profiling, operating system configuration, and target deployment. Consequently, the key to empowering Embedded Windows developers lies in adding additional features to the Microsoft offerings so that developers have the best of both worlds—the best development tools combined with a rich set of capabilities for embedded application development.

Extending Microsoft's Desktop Tools for use in Embedded Development

Intrinsyc's Integration Expert (IX) is implemented as a stand-alone application combined with a Microsoft Developer Studio add-in. The stand-alone application allows users to easily select components from a component gallery, add their own user defined components, perform a wide variety of target and application performance analysis functions, and finally generate a bootable target image for Windows 95, Windows NT and Windows CE. The Microsoft Developer Studio add-in allows developers to quickly calculate total application disk and memory footprints, analyze application and library inter-dependencies, and deploy the application with all required components on the target embedded system, all while working within the familiar Microsoft development environment.

Integration Expert provides a powerful suite of analysis tools to help build and integrate high-quality minimum footprint systems. Some of the Integration Expert analysis capabilities include: dependency analysis, conversion, reduction and checking; unnecessary component elimination; and footprint calculation. These tools help the user to deal with complex, ever-changing application software, operating systems, device drivers, and configuration data. Unlike systems that rely on hand-coded databases to assist in this task, Integration Expert is highly automated and can repeat analysis operations again and again when inevitable changes take place.

Value-Added Software Components for Embedded Development

The tremendous variety of sophisticated full-featured desktop applications available for Windows 95 and Windows NT can be attributed to the component-based software development paradigm, which enables users to "build software from parts, not from scratch." Embedded Windows applications can benefit in the same manner by the introduction of value-added software components that deliver sophisticated functionality for use in the construction of typical embedded systems.

Intrinsyc Software supplies software component libraries used by programmers to create embedded systems. These products enable customers to rapidly create and deploy applications for acquisition, control, logging, monitoring, and processing.

Data Acquisition and Processing

Intrinsyc Software supplies an application framework plus extensive software component libraries for data acquisition and processing. Developers of dedicated systems can draw from any of the hundreds of proven components that are bundled with Intrinsyc SP. These components range from simple bitwise operators and mathematical processors to FFT processors, powerful schedulers and state machines.

Fault Tolerance

Win32 operating systems provide a strong base for reliable system operation, but for many applications there is the need for software fault detection and correction. Intrinsyc's WinFT 2.0 delivers fault detection and correction features for new and legacy Win-32 applications. WinFT was designed for developers and administrators of fault tolerant Win32 applications and systems. Developers can use the simple API provided by the WinFT library to quickly and easily build fault tolerant features into their applications. Administrators can use the Watchdog Server to configure and monitor their fault tolerant systems to ensure optimal performance.

Connectivity

Embedded Windows applications will be expected to communicate to Desktop PCs, over the Internet, and to other Embedded Win32 devices. Intrinsyc's Rainbow delivers HTTP Web server technology designed specifically for Windows CE. This highly efficient and compact web server software has the potential to allow millions of Windows CE based embedded computers to be accessible directly on the Internet using commonly available web browsers. Rainbow is packaged for easy adaptation for use by OEMs for their custom applications.

Integration Services to Reduce the Win32 Learning Curve

Intrinsyc Software offers a wide range of services including prototype development, software integration, software development, training, maintenance, and support. These services are designed to enable original equipment manufacturers, system integrators, and independent hardware and software vendors to quickly develop embedded products and bring them to market.

Intrinsyc's engineers and software developers can accelerate development programs by providing expert technical assistance during product definition, design, and implementation phases. A typical Embedded Windows solution delivered by Intrinsyc will involve some combination of central development, administration, and operations for a network of embedded devices. The embedded devices are normally running Win32 operating systems, including Windows NT for large integrated applications and Windows CE for smaller more special-purpose applications.

Summary

Intrinsyc Software's development tools, software component libraries, and integration services combined with Microsoft's Win32 technologies provide the ideal solution for embedded system development.