A Win for All Parties

These benefits make the UDI specification a win for parties that in the past might have opposed a broader effort at UNIX® unification. The impact will be felt by IT departments, operating system vendors (OSVs), and platform and independent hardware or peripherals vendors (OEMs and IHVs).

Operating System Vendors

With a common device model, operating system vendors can reduce their development costs and focus their development efforts on customer interfaces and features that add value to the business user and earn customer loyalty, rather than on low-level "plumbing."

OS vendors can't afford to write drivers for all the hardware they need to support. A common device model ensures a wide range of peripheral support for UDI-compliant UNIX operating system implementations and reduces the vendors' porting costs and support load.

IT Departments

An industry-wide device interface specification will enable vendors to spend less time porting and more time innovating. This will produce a wider range of products for IT organizations to choose from, expanding the number, variety and robustness of peripherals available for Intel-based servers running the UNIX operating system and making it easier to qualify and deploy them. Consequently, customers will have a greater range of choices, not only of server operating systems for their Intel-based servers but also of peripherals and other components.

Platform and Peripherals Vendors

A common driver model benefits server OEMs and IHVs who design and manufacture storage devices, printers and other server peripherals. Currently, IHVs must write or modify a driver for each UNIX flavor their products support. With a common driver model, IHVs need only write to the common driver model to ensure that their products run under all UDI-compliant UNIX operating systems. In this way IHVs can not only reduce their development efforts and porting and support costs, but also enlarge their markets by broadening the number of operating systems their products support. Along with benefiting from these economies of scale, IHVs, as well as platform vendors, can concentrate their development efforts on product innovations rather than porting device drivers to numerous operating systems.

Platform OEMs experience similar benefits, particularly in the area of broader markets and economies of scale. With the UDI specification, a platform vendor no longer has to test devices with all variants of UNIX. This savings in time and effort can reduce both time to market and the expense of driver validation and make it easier to provide complete, reliable solutions to the OEMs' customers.

Conclusion

Intel architecture-based systems owe their success in part to the existence of an open, high-volume marketplace with a broad range of vendors who add value to their products; this scenario benefits user organizations through rapid technology innovation and a wide range of cost-effective choices. Intel's UNIX Developer's Interface Guide Program is the first step in an effort to facilitate a broader UNIX market with more vendors and products, to help enterprise users combine the cost and performance advantages of the Intel architecture with the reliability and scalability of the UNIX operating system.

Creating duplicate device drivers for various vendors' UNIX implementations adds more cost than it creates in value for the customer. An industry-wide UDI specification will reduce this duplication, which in turn will minimize some of the complexity of the IT infrastructure and lower the costs of adapting new technologies. This effort is broadly supported by widely disparate elements of the UNIX community, who recognize the value of a common driver model.

By working with the industry to complete a common UNIX device driver specification and by making an optimized implementation for the Intel architecture freely available, Intel is working to ensure that any vendor can provide high-performance peripherals for Intel-based servers and clients running the UNIX operating system. In addition, the UDI implementation will be forward-compatible with future Intel IA-64 processors, giving developers and customers the assurance of a smooth transition to next-generation Intel technologies.

The result will be to increase differentiation that adds value, reduce redundant engineering porting efforts, foster innovation and ensure that customers can enjoy high-performance Intel-based servers whatever their operating system of choice.

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For more information please visit http://developer.intel.com/go/dev_guides

Accelerating UNIX* Deployment on Intel-Based Servers:

The Intel UNIX Developer's Interface Guide Program

An Intel White Paper

Intel will join with other members of Project UDI to complete development of a Uniform Driver Interface for the UNIX* operating system and will deliver a freeware implementation optimized for the Intel architecture. It's the first step in a broad-based program to help business users combine the economies of scale afforded by Intel-based servers with the reliability advantages of UNIX.

Commonality across various UNIX Environments

The economies of scale, wide range of choices and price/performance advantages of the Intel architecture have made Intel-based servers and workstations the platforms of choice for a wide range of businesses. The increasing performance and scalability of the Intel® Pentium® II Xeon™ processor and forthcoming IA-64 processors are now driving the Intel architecture higher and deeper into the data center and server marketplace.

Benefits for a Growing Segment

In this data center segment, the UNIX® operating system is popular because of its high reliability, scalability and powerful features. According to International Data Corp. (IDC), UNIX accounted for 33 percent ($21.9 billion) of the $65.7 billion 1997 server market by dollar volume, and will expand to $27.6 billion as the server market grows to a total $88.5 billion in 2002.

However, the number and variety of UNIX "flavors" creates interoperability problems for information technology (IT) organizations, limits market growth for software vendors, and increases the development and validation costs for platform and device developers. Previous efforts to overcome proprietary differences and create a single version of UNIX have failed because competing vendors have a strong and understandable interest in protecting features they've developed that differentiate "their" UNIX from that of their competitors, and in ensuring high performance.

To advance the deployment of the UNIX operating system on Intel-based servers and workstations, Intel is focusing energy on a broad-based program that aims to provide a greater degree of commonality across various UNIX environments while avoiding the pitfalls of attempting to "unify" UNIX. Rather than attempting to achieve application-level consistency across all versions of UNIX, Intel will focus more on the hardware interface level. Specifically, Intel will work with others in the industry to specify interfaces that enable third-party drivers and adapters to work across all UNIX flavors and eventually run on any platform.

This approach should benefit both customers and vendors. Customers will preserve their freedom of choice, enjoy more consistent, stable interfaces and therefore spend less time qualifying new devices and systems, reduce the costs of deploying new technologies and ensure the ability to combine the reliability advantages of UNIX with the price/performance benefits of the Intel architecture. Product developers will broaden markets, free design resources to focus on higher value areas, and reduce the costs of development, validation and testing.

This white paper explains what steps Intel is taking, how the above benefits will be achieved, and why the current effort will be successful.

Design Guidelines

Platform design guidelines have benefited the PC industry by providing a technology road map, recommending key technologies and practices, and defining common hardware and peripheral interfaces. In the server marketplace, where the design decisions are more complex and the need to ensure a balanced, high-performance system architecture is paramount, design guidelines are even more important. Accordingly, Intel will create a UNIX Developer's Interface Guide to aid in developing high-performance servers based on the Intel architecture.

The first instantiation of the UNIX Developer's Interface Guide for IA-64 Servers (UDIG) will include a driver development kit and will later be broadened to incorporate recommendations and standards for I/O and management. The guide will define a set of interfaces and usage models that enable hardware developers to create drivers with the assurance of interoperability and compatibility across various flavors of UNIX and various hardware platforms. By following the UDIG, system developers and integrators can speed their time to market and ensure high quality, performance-optimized designs. By specifying servers that adhere to the UDIG, businesses can increase the interoperability of their IT infrastructure and choose the operating system that best meets their needs while maintaining a common computing foundation based on the Intel architecture.

UDI as Device Driver Interface

A key element of the UNIX Developer's Interface Guide for IA-64 Servers is the device driver specification, which describes the interface between peripheral devices (LAN, SCSI, storage devices, etc.), the operating system and platform hardware. Currently, the industry lacks a common driver model for UNIX. As a result, each UNIX operating system vendor creates its own interface, and peripheral vendors must write (and validate) a separate driver for each flavor of UNIX they want their products to support.

As a first step in its UDIG program, Intel has joined the existing Project UDI (Uniform Driver Interface) group and will volunteer engineering resources to help expedite the Project UDI specification. Project UDI is an open multi-vendor working group formed in 1994 to create an OS-neutral device driver standard. Members of Project UDI include hardware vendors Adaptec, Bit3 and Interphase, and UNIX operating system vendors Compaq-Digital, Hewlett-Packard, IBM, SCO and Sun/Solaris to complete the UDI specification. The completed Project UDI specification will be the driver interface for the UDIG. Once the first instantiation of this specification is finalized, Intel will deliver a UDI reference implementation of the interface framework, optimized for the Intel architecture, for the most common server interfaces including SCSI, Ethernet, the Universal Serial Bus (USB) and I_2O, the intelligent I/O architecture. The completed source code will be given freely to commercial UNIX vendors in cooperation with Project UDI. In addition, Intel will release a Linux implementation as freeware to the Linux open source community in cooperation with the Project UDI industry group. The freeware release will include self-certifying compliance test suites to ensure that drivers conform to the UDI specifications.

Solving the "Driver Problem" and Avoiding the "Unifying UNIX Problem"

The UNIX marketplace has long been fragmented by different varieties of UNIX offered by competing vendors; efforts to unite the industry around a single version of UNIX have been unsuccessful. Rather than form another consortium and attempt another futile run at achieving application-level consistency among all flavors of UNIX, Intel has chosen to focus on a more modest task: ensuring portability of device drivers across UNIX operating systems running on Intel-based servers. This approach not only has a far higher likelihood of success than any grand unification scheme, but will pay significant benefits to all segments of the server industry as well as to business customers and IT organizations.

Device drivers provide functionality for system components and are integral to performance. Once a driver is created, vendors today spend many hours duplicating their drivers for each different UNIX flavor they want to support. This duplication is necessary to enable their products to run with different operating system products, but there's little return on the vendor's investment in proprietary drivers and little intellectual property for vendors to protect. For third-party device developers, the burden of creating or modifying the driver for each operating system and platform a device will run on can be extremely onerous. This effort not only limits the economies of scale available to vendors, but also ends up limiting the number of choices available in the marketplace. It even inhibits vendors' ability to focus on innovation because they must spend so much time on redundant porting efforts.

The lack of an industry-wide interface specification for device drivers causes headaches for customers and throughout the industry as well. As phone support technicians know all too well, a minor change to a device driver can create effects that ripple through the industry. An original equipment manufacturer (OEM) may modify a single line of code in a device driver when they switch to a new vendor to save a few cents on a minor part or to take advantage of a new technology. While the BIOS vendor may spend two weeks recoding for the new driver, the independent software vendor (ISV) may need two months to recode for the new BIOS and the business IT organization that purchases the resulting system may spend three months validating and qualifying its software to run on the modified system. If the part change isn't substantial enough to show up in the product specification, IT may not realize there's even been a change—until users start calling to report problems.

Because it will provide an industry-wide driver interface specification, Project UDI offers the industry a chance to remove the redundant efforts needed to support various UNIX implementations which result in duplicated efforts that add costs but do not add value. Intel's reference implementation will ensure a performance-tuned version for the Intel architecture.

The combination of Project UDI and Intel's efforts will help reduce complexity throughout the industry, freeing vendors to put the time and engineering talent that would have gone into driver development and optimization to uses that can more effectively differentiate their products in the marketplace. It will also reduce the burden costs of innovation, speeding vendors' times to market and enabling IT organizations to more readily enjoy the benefits of new server technologies while minimizing the sometimes negative consequences of change.

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