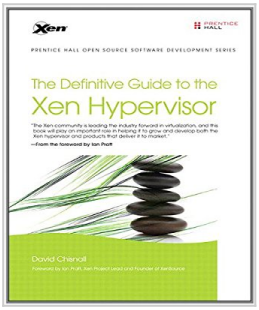

The Definitive Guide to the Xen Hypervisor (Prentice Hall Open Source Software Development Series)

By David Chisnall

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“The Xen hypervisor has become an incredibly strategic resource for the industry, as the focal point of innovation in cross-platform virtualization technology. David’s book will play a key role in helping the Xen community and ecosystem to grow.”
–Simon Crosby, CTO, XenSource

An Under-the-Hood Guide to the Power of Xen Hypervisor Internals

The Definitive Guide to the Xen Hypervisor is a comprehensive handbook on the inner workings of XenSource’s powerful open source paravirtualization solution. From architecture to kernel internals, author David Chisnall exposes key code components and shows you how the technology works, providing the essential information you need to fully harness and exploit the Xen hypervisor to develop cost-effective, highperformance Linux and Windows virtual environments.

Granted exclusive access to the XenSource team, Chisnall lays down a solid framework with overviews of virtualization and the design philosophy behind the Xen hypervisor. Next, Chisnall takes you on an in-depth exploration of the hypervisor’s architecture, interfaces, device support, management tools, and internals—including key information for developers who want to optimize applications for virtual environments. He reveals the power and pitfalls of Xen in real-world examples and includes hands-on exercises, so you gain valuable experience as you learn.

This insightful resource gives you a detailed picture of how all the pieces of the Xen hypervisor fit and work together, setting you on the path to building and implementing a streamlined, cost-efficient virtual enterprise.

Coverage includes
· Understanding the Xen virtual architecture

· Using shared info pages, grant tables, and the memory management subsystem
· Interpreting Xen’s abstract device interfaces
· Configuring and managing device support, including event channels, monitoring with XenStore, supporting core devices, and adding new device types
· Navigating the inner workings of the Xen API and userspace tools
· Coordinating virtual machines with the Scheduler Interface and API, and adding a new scheduler
· Securing near-native speed on guest machines using HVM
· Planning for future needs, including porting, power management, new devices, and unusual architectures

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Editorial Review

About the Author

David Chisnall is a regular columnist for InformIT and is nearing completion of a Ph.D. in computer science from the University of Wales. He cofounded and actively contributes to the open source Étoilé desktop environment, participated in a Knowledge Transfer Project, and has jumped enthusiastically into numerous other in-the trenches tech adventures.

This book aims to serve as a guide to the Xen hypervisor. The interface to paravirtualized guests is described in detail, along with some description of the internals of the hypervisor itself.

Any book about an open source project will, by nature, be less detailed than the code of the project that it attempts to describe. Anyone wishing to fully understand the Xen hypervisor will find no better source of authoritative information than the code itself. This book aims to provide a guided tour, indicating features of interest to help visitors find their way around the code. As with many travel books, it is to be hoped that readers will find it an informative read whether or not they visit the code.

Much of the focus of this book is on the kernel interfaces provided by Xen. Anyone wishing to write code that runs on the Xen hypervisor will find this material relevant, including userspace program developers wanting to take advantage of hypervisor-specific features.

Overview and Organization

This book is divided into three parts. The first two describe the hypervisor interfaces, while the last looks inside Xen itself.

Part I begins with a description of the history and current state of virtualization, including the conditions that caused Xen to be created, and an overview of the design decisions made by the developers of the hypervisor. The remainder of this part describes the core components of the virtual environment, which must be supported by any non-trivial guest kernel.

The second part focuses on device support for paravirtualized and paravirtualization-aware kernels. Xen provides an abstract interface to devices, built on some core communication systems provided by the hypervisor. Virtual equivalents of interrupts and DMA and the mechanism used for device discovery are all described in Part II, along with the interfaces used by specific device categories.

Part III takes a look at how the management tools interact with the hypervisor. It looks inside Xen to see how it handles scheduling of virtual machines, and how it uses CPU-specific features to support unmodified guests.

An appendix provides a quick reference for people wishing to port operating systems to run atop Xen.

Book Conventions

This book uses a number of different typefaces and other visual hints to describe different types of material.

Longer listings have line numbers down the left, and a gray background. In all listings, bold is used to indicate keywords, and italicized text represents strings and comments.

Listings that are taken from external files will retain the line numbers of the original file, allowing the referenced section to be found easily by the reader. The captions contain the original source in square brackets. Those beginning with *example/* are from the example sources. All others, unless otherwise specified, are from the Xen sources.

Comments from files in the Xen source code have been preserved, complete with errors. Since the Xen source code predominantly uses U.K. English for comments, and variable and function names, this convention has been preserved in examples from this book.

During the course of this book, a simple example kernel is constructed. The source code for this can be downloaded from: http://www.prenhallprofessional.com/title/9780132349710.

Use as a Text

In addition to the traditional uses for hypervisors, Xen makes an excellent teaching tool. Early versions of Xen only supported paravirtualized guests, and newer ones continue to support these in addition to unmodified guests. The architecture exposed by the hypervisor to paravirtualized guests is very similar to x86, but differs in a number of ways. Driver support is considerably easier, with a single abstract device being exposed for each device category, for example. In spite of this, a number of things are very similar. A guest operating system must handle interrupts (or their virtual equivalent), manage page tables, schedule running tasks, etc.

This makes Xen an excellent platform for development of new operating systems. Unlike a number of simple emulated systems, a guest running atop Xen can achieve performance within 10% that of the native host. The simple device interfaces make it easy for Xen guests to support devices, without having to worry about the multitude of peripherals available for real machines.

The similarity to real hardware makes Xen an ideal platform for teaching operating systems concepts. Writing a simple kernel that runs atop Xen is a significantly easier task than writing one that runs on real hardware, and significantly more rewarding than writing one that runs in a simplified machine emulator.

An operating systems course should use this text in addition to a text on general operating systems principles to provide the platform-specific knowledge required for students to implement their own kernels.

Xen is also a good example of a successful, modern, microkernel (although it does more in kernelspace than many microkernels), making it a good example for contrasting with popular monolithic systems.

Users Review

From reader reviews:

Sandra Yunker:

Why don't make it to be your habit? Right now, try to ready your time to do the important behave, like

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John Sledge:

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Kent Brown:

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