Hypervisor and XEN

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Reference: Distributed and Cloud Computing

K. Hwang, G. Fox and J. Dongarra

Overview

- Hypervisor
- Types of Hypervisor
- Xen Architecture

Hypervisor

- A hypervisor is a **hardware virtualization** technique allowing **multiple operating systems**, called guests to run on a **host machine**. This is also called the **Virtual Machine Monitor** (VMM).

- Two types of Hypervisors
  - **Bare-Metal Hypervisor**
  - **Hosted Hypervisor**

Hypervisor

- Hypervisor provides hypercalls to the guest OSes and applications.
- Depending on functionality Hypervisor can be of
  - **Micro-Kernel Architecture**
  - **Monolithic Hypervisor Architecture**

Hypervisor

- **Micro-kernel hypervisor** includes only the **basic** and **unchanging** functions (such as **physical memory management** and **processor scheduling**).
- The **device drivers** and other changeable components are **outside** the **hypervisor**.
- **Monolithic hypervisor** implements **all** the aforementioned **functions**, **including** those of the **device drivers**.
- The **size** of the hypervisor code of a **micro-kernel hyper- visor** is **smaller** than that of a **monolithic hypervisor**.

Xen Architecture

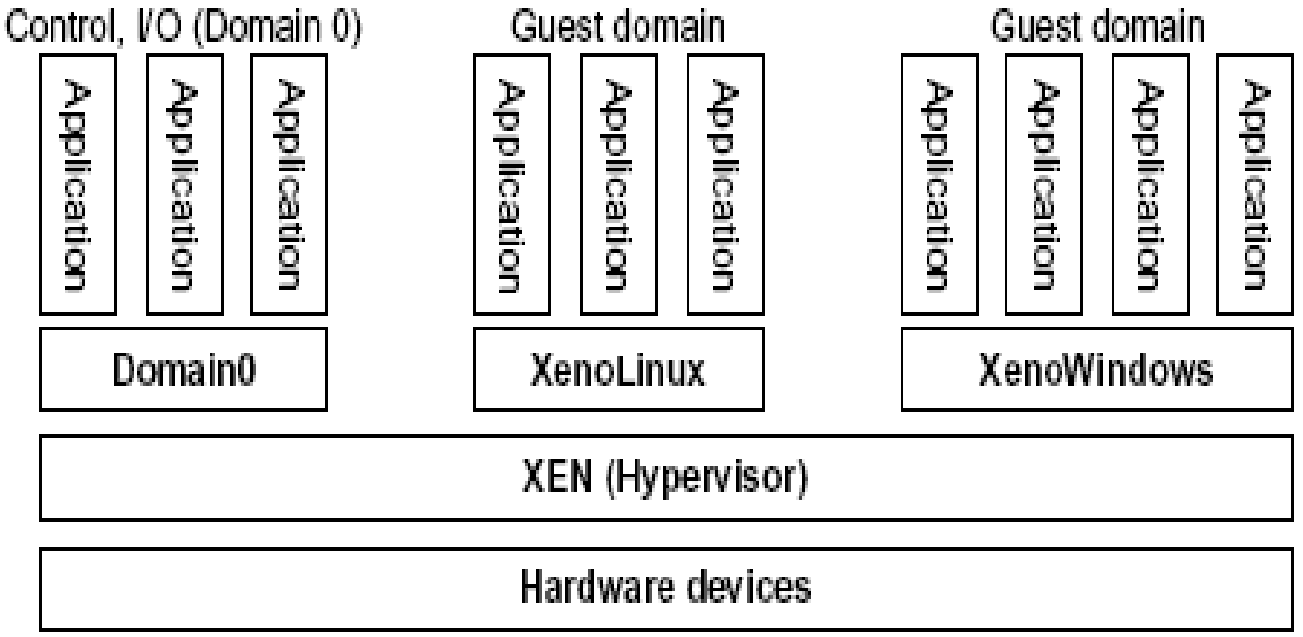

FIGURE 3.5

The Xen architecture's special domain 0 for control and I/O, and several guest domains for user applications.

Xen Architecture

- Xen is an **open source hypervisor** program developed by Cambridge University.
- Xen is a **micro- kernel hypervisor**, which separates the policy from the mechanism.
- The Xen hypervisor implements all the mechanisms, leaving the **policy** to be handled by **Domain 0.**
- Xen does not include any **device drivers** natively.
- It just provides a mechanism by which a **guest OS** can have **direct access** to the **physical devices**

Xen Architecture

- The core components of a Xen system are the **hypervisor**, **kernel**, and **applications**.
- Many guest OSes can run on top of the hypervisor.
- However, **not all guest OSes** are created **equal**, and **one** in particular **controls** the **others**.
- The guest OS, which has **control** ability, is called **Domain 0**, and the **others** are called **Domain U**.
- **Domain 0** is a **privileged guest OS** of Xen.
- It is **first loaded** when **Xen boots** without any file system drivers being available.

Xen Architecture

- **Domain 0 is designed to access hardware directly and manage devices. Domain 0 is to allocate and map hardware resources for the guest domains (the Domain U domains)**
- Xen is based on **Linux** and its **security level** is **C2**.
- Its management VM is named **Domain 0**, which has the privilege to manage other VMs implemented on the same host.
- If **Domain 0** is **compromised**, the **hacker** can control the **entire system**. **So Security Policies need to be improved.**

Major VMM and Hypervisor Providers

VMM Provider	Host CPU	Guest CPU	Host OS	Guest OS	VM Architecture
VMware Work-station	X86, x86-64	X86, x86-64	Windows, Linux	Windows, Linux, Solaris, FreeBSD, Netware, OS/2, SCO, BeOS, Darwin	Full Virtualization
VMware ESX Server	X86, x86-64	X86, x86-64	No host OS	The same as VMware workstation	Para-Virtualization
XEN	X86, x86-64, IA-64	X86, x86-64, IA-64	NetBSD, Linux, Solaris	FreeBSD, NetBSD, Linux, Solaris, windows XP and 2003 Server	Hypervisor
KVM	X86, x86-64, IA64, S390, PowerPC	X86, x86-64, IA64, S390, PowerPC	Linux	Linux, Windows, FreeBSD, Solaris	Para-Virtualization

Summary

- Hypervisor
- Types of Hypervisor
- Xen Architecture

References

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4. “Open Virtualization Format for Virtual Machines”, available at http://www.vmware.com/appliances/getting-started/learn/ovf.html

THANK YOU