Xen and the Art of Virtualization
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What is the problem?

Virtualization enables resources to be securely shared among virtual machines which need to run 100s of intensive applications. However, existing systems have major limitations such as relying on specialized hardware and operating systems, and sacrificing either performance, security or functionality.

Summary

The paper presents a new paravirtualization design enabled through the virtual machine monitor, Xen. The design places emphasis on performance and resource management. Xen allows multiple (up to 100 in testing) close-to-commodity operating systems (Linux and Windows XP) to utilize shared hardware in a secure manner. The performance of Xen is close to un-virtualized systems and significantly better than other commercial virtualization softwares.

Key Insights

- Although full virtualization can support unmodified guest OS, it has several drawbacks as guest OSs can perform significantly better if it has knowledge about the virtualization.
- The Application Binary Interface needs to work unmodified for users and application developers to easily transfer to Xen.

Strengths

- Xen occupies a 64 MB section at the top of every address space negating the need for a TLB flush and context-switching overhead.
- Xen's paravirtualized design enables high performance, strong resource isolation and support for uncooperative machine architectures such as the x86.

Weaknesses

- Xen hides the full power of hardware devices by providing device I/O through device abstractions.
- The modifications to be made to a guest OS other than Linux might be more. For instance, the paper states that Windows XP needs more modifications. There might need to be more code as the OS versions change as well.

Summary of Key Results

- The performance of Xen is comparable to that of native Linux.
- Xen significantly outperforms other commercial virtualization solutions.

Open Questions

- What are the research questions that can answer how Xen will update with respect to updates to guest operating systems?