



JavaGuest - A Research Java™ Virtual Machine on Xen

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Context

- Java™ 6 provides a complete platform for server-side applications
- No application-level native code
- JVM™ dynamic compiler can generate optimal machine code from Java bytecodes

Problem

- Platform libraries are (partly) implemented by JVM native code and operating system code layers
- Crossing these layers can be expensive
- Dynamic compiler has no visibility into these layers
- JVM on bare-metal is a lot of (ongoing) work

Opportunity

- Para-virtualization API dramatically reduces barrier to entry for “bare-metal” JVM
- Multiple guest allows incremental approach to implementing I/O support
- Project Maxwell VM
 - > Sun Labs research JVM written in Java 6 enables an all-Java software stack

Goals

- Enable optimized, specialized, server-side Java applications with an all-Java software stack
- Exploit access to low-level mechanisms for thread scheduling, memory management
- Simplify development, administration of applications

Related Work

- BEA LiquidVM
 - > JRockit JVM on “bare-metal”
 - > VMWare/Xen

- IBM Libra
 - > J9 JVM on Libra “library operating system”
 - > i.e., Libra is an extended “Mini-OS”
 - > Libra off-loads network/disk to sibling guest

Initial Prototype

- Build on enhanced Mini-OS
 - > SMP support
 - > Pre-emptive threading
 - > Debugging support
- File I/O delegated to sibling guest
 - > Pseudo device driver
- Network stack in domain
 - > Written in Java

Debugging

- Project Maxwell Inspector
 - > GUI-based debugger that understands Project Maxwell VM data structures
 - > Uses ptrace (Linux), libproc (Solaris) to communicate with target VM
 - > Ported to Xen using pseudo-device driver
 - > provides ptrace-like support
 - > Uses user-level grant table device driver
 - > Only available for Linux
 - > Inspector has to run as root

Status and Future Work

- Status
 - > Simple programs running
 - > Inspector mostly working

- Future Work
 - > Network stack
 - > Build up to production application
 - > Application server, Game server
 - > Rewrite Mini-OS in Java
 - > Optimization and specialization
 - > Open Source mid-2008

More Info

- Email: mick.jordan@sun.com
- Project Maxwell VM:
 - > <http://research.sun.com/projects/maxwell>
- JavaGuest Project:
 - > <http://research.sun.com/projects/javaguest>