Virtualization

8 March 2007

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Platform Virtualization

- ## Hosted
  - Microsoft Virtualization Server
  - VMWare

- ## Non-hosted
 - Xen

Benefits of Virtualization
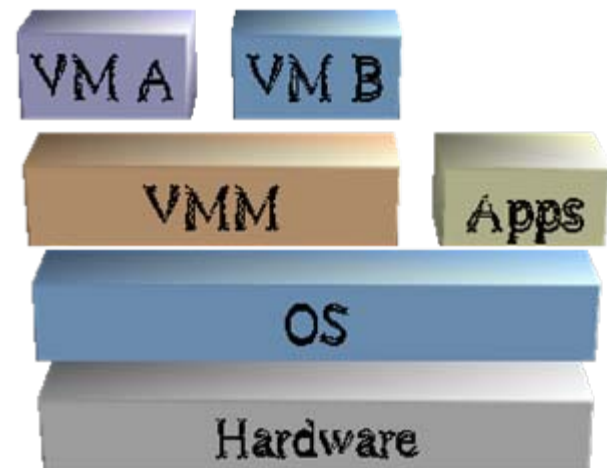
- **General application:**
  - Server consolidation

- **GRID/HPC specific:**
  - Secure isolation between VMs
    - Isolation of users and malicious software
  - Software flexibility
    - Let each user manage their own OS
    - And satisfy their own software dependencies
  - Utilisation of SMP and multi-core resources
  - Live Migration of VMs across nodes
  - Checkpointing
  - Utilisation of public computing resources

- Paravirtualization
    - -> Close to native performance
    - Requires kernel modification
- Also supports full virtualization with Intel VT
- Supports IA32, EM64T and IA64 architectures
- Mature and rich feature set
    - Live Migration
    - Flexible CPU/core allocation
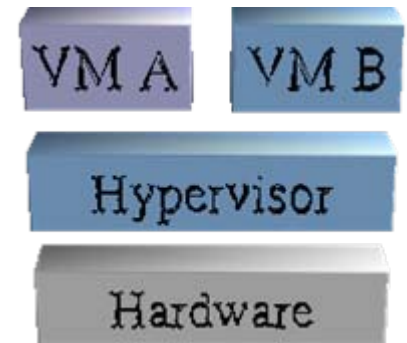
- New player, but quite stable
- Takes benefit from hardware extensions for virtualization (VT-x)
- A monolithic hypervisor
    - The hypervisor is compiled as a kernel module and loaded into kernel-space at runtime
- Supports live-migration
- Para-virtualization under development
- IA64 port under development
- No in-VM SMP support

- Virtualization hardware extensions alleviate fundamental performance problems
- EM64T – VTx
- IA64 – VTi
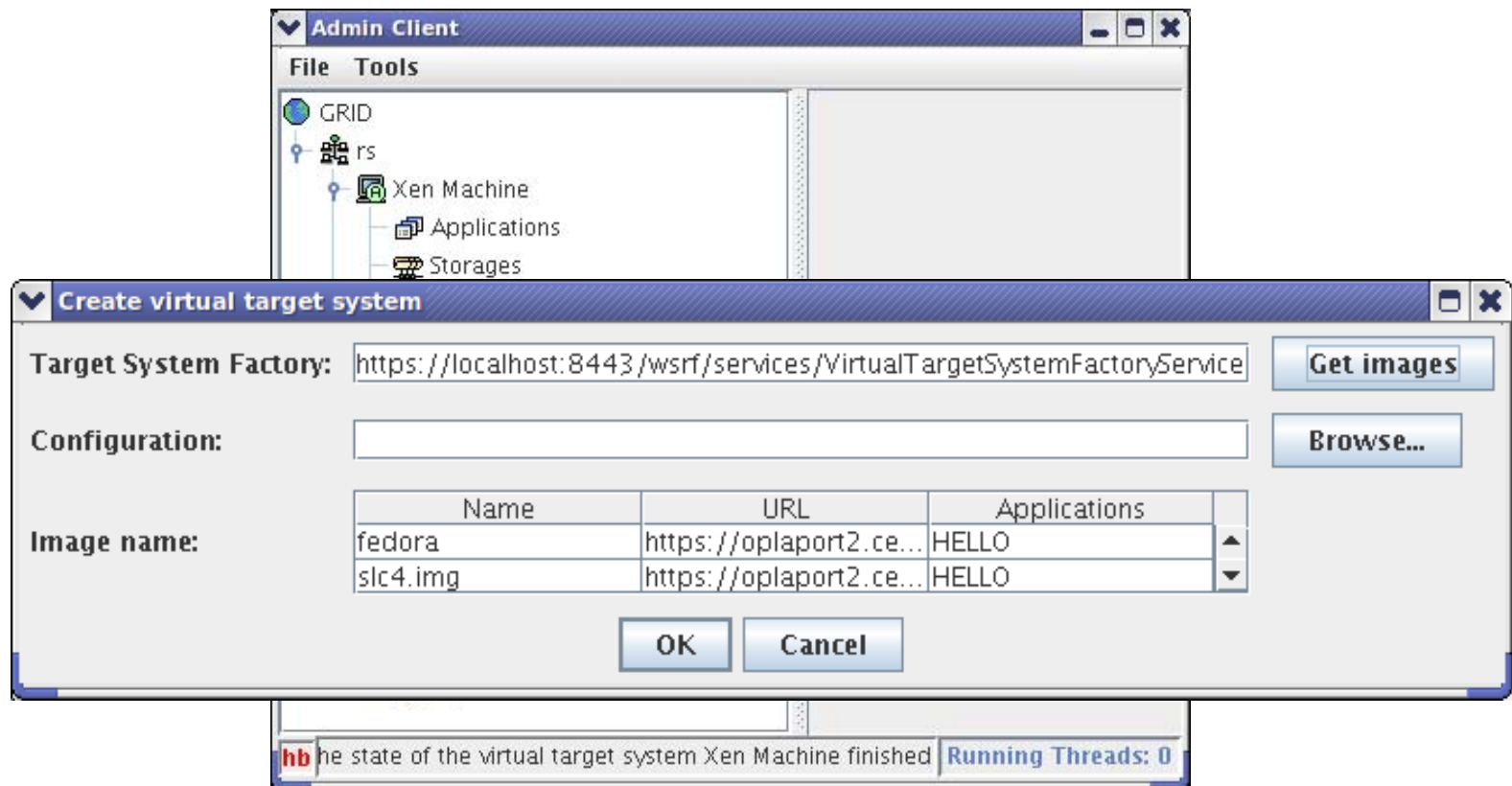- VTd will give better I/O and MMU virtualization

VMX Nonroot		VMX Root
3 User apps	VMEXIT →	3 Control
2		2
1	← VMENTRY	1
0 Guest kernel		0 Hypervisor
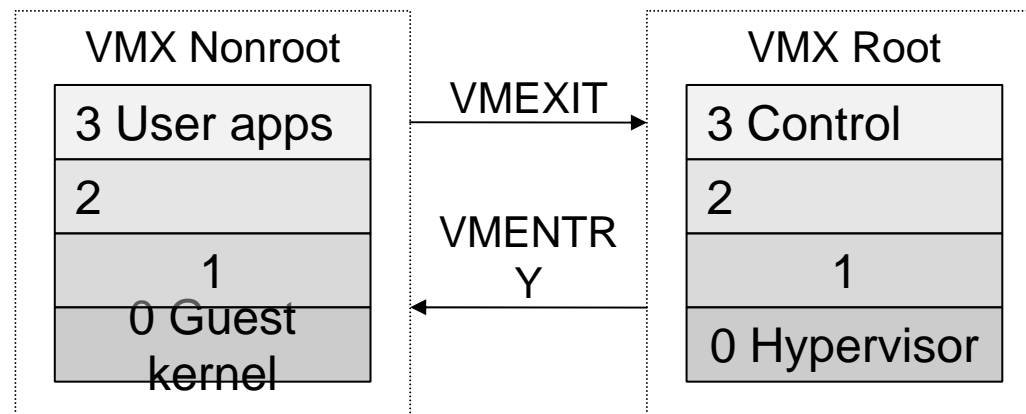
Grid Programming Environment

- API to develop and deploy Grid application beans

- Service-oriented Architecture
  - Target systems (computational resource)
  - Job management
  - Storage management
  - File transfer

- Integrates with Virtual Workspaces for dynamic resource provisioning

- The only Grid middleware to offer full platform virtualization support

- **Standards**
  - Job Submission Description Language (jobs)
    - Open Grid Forum's standard for specifying requirements for jobs
  - Business Process Execution Language (workflows)
    - Orchestrating interaction between webservices
    - Backed by IBM, SAP, Microsoft
  - Common Information Model (resources)
    - Model description of resources
    - Backed by DMTF

- Can use Virtual Workspaces' built in scheduler to deploy VMs

- ## OS Farm
  - ## Execution Environment Centric

- ## CPU-intensive application:
  - ### Event simulation with Geant4

Performance Characteristics
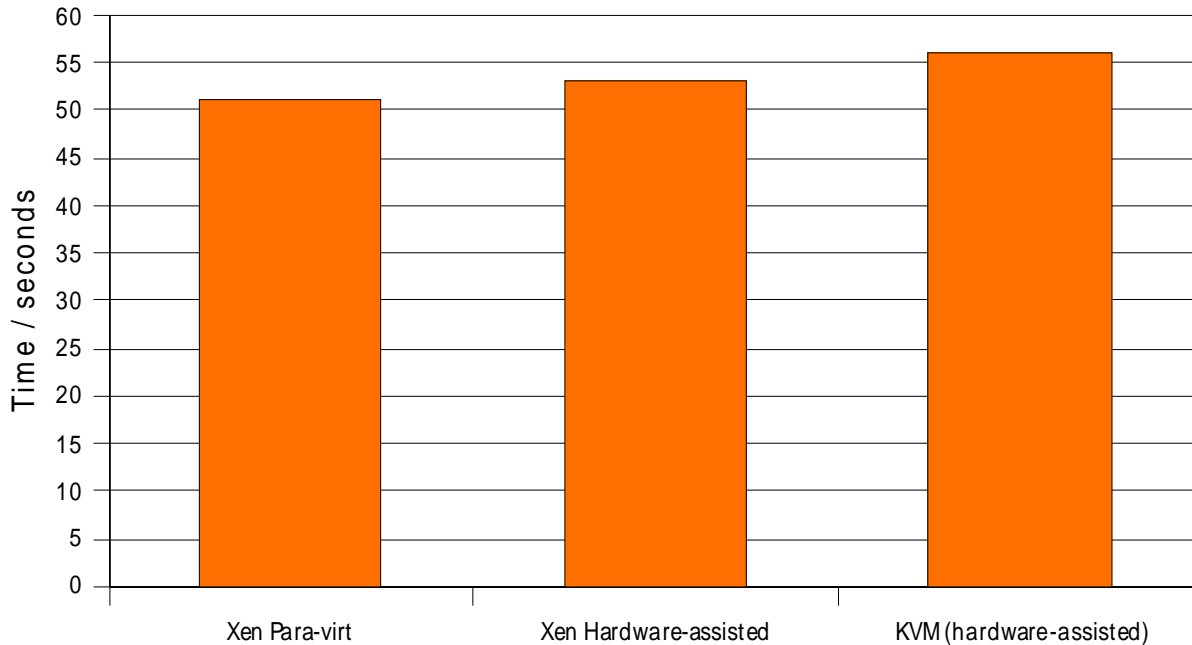
- ## I/O-intensive benchmark
  - ### Write 1 GB file

Performance Characteristics
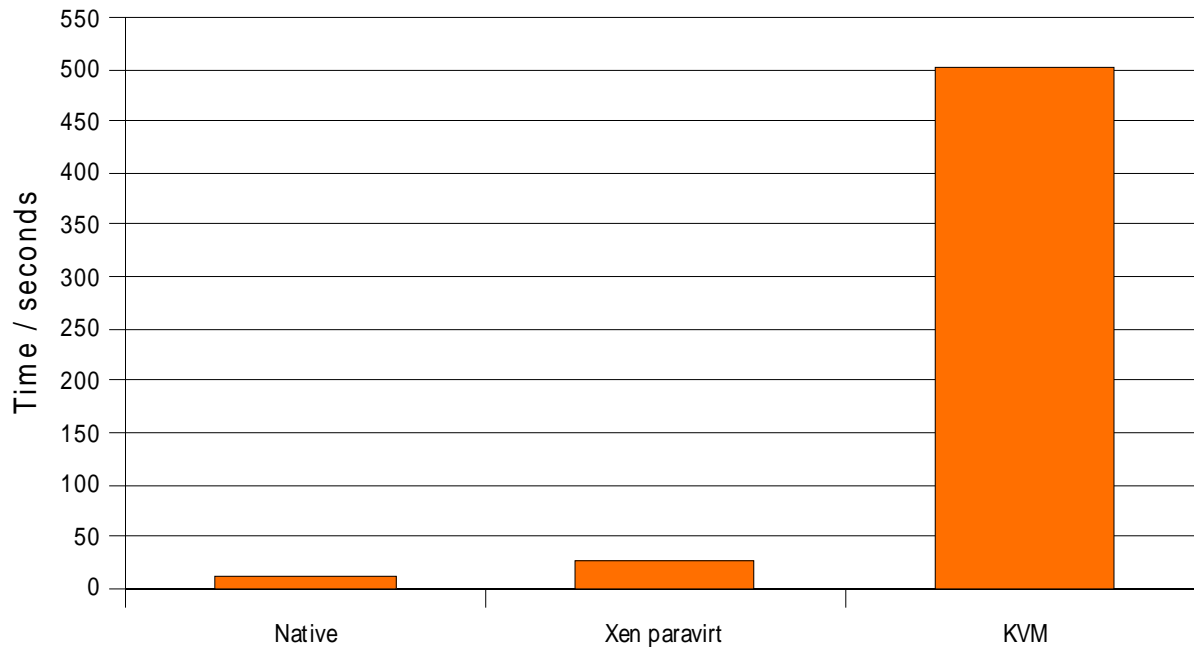
- ## MMU microbenchmark
  - ### 10k page faults