HEP Applications in Virtual Machines

Jakob Blomer

April 15th 2008
(Benchmarks of Summer 2007)

Delivering Software

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Virtualization Techniques

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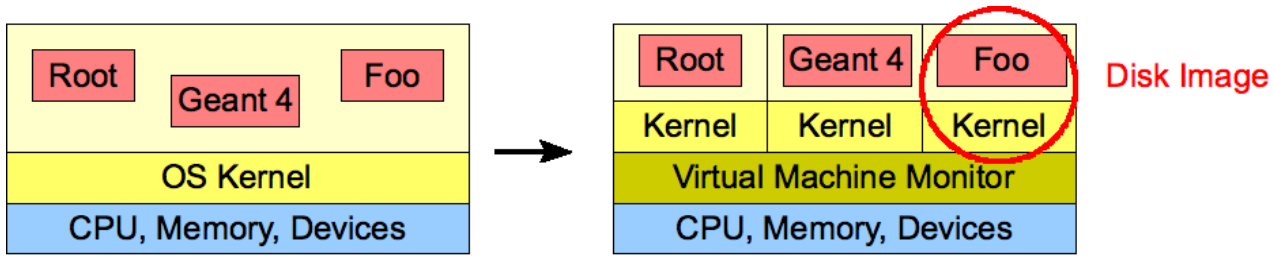

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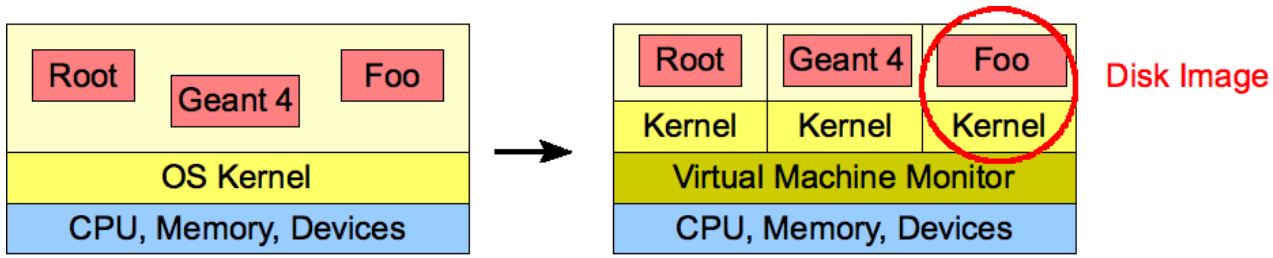

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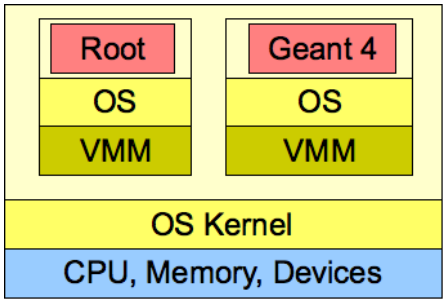

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VMware Server (GSX) / WS:	Dynamic Code Rewriting
MS Virtual PC:	Dynamic Recompilation

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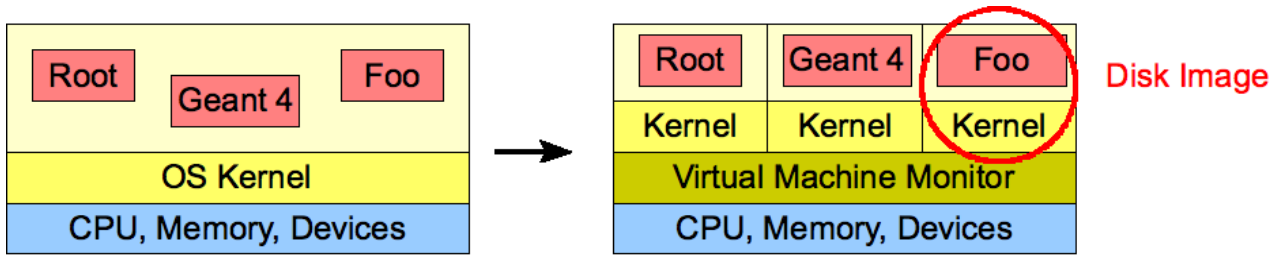

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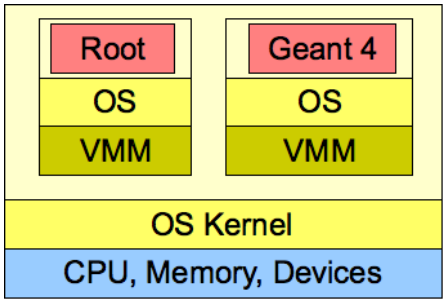

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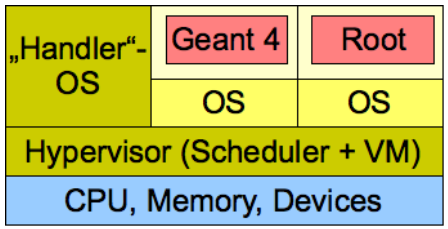
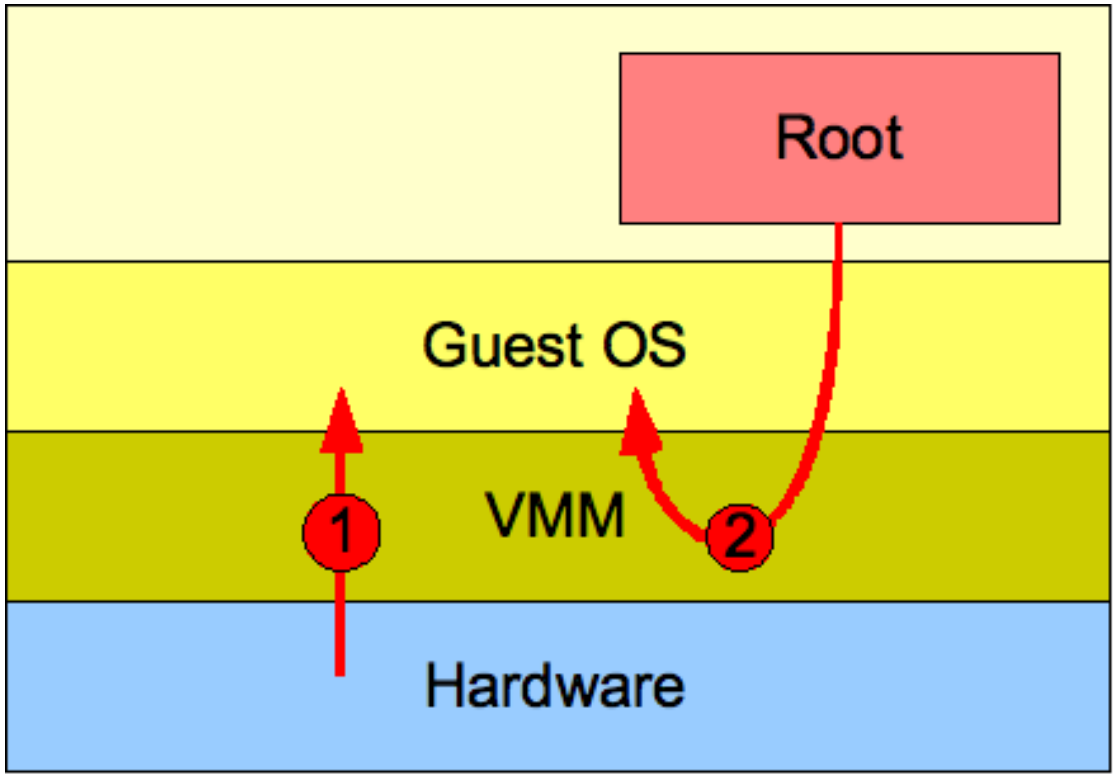


Xen, VMware ESX:	Hypervisor + Mgmt OS
KVM:	Hypervisor = Mgmt OS

Critical & Expensive Operations (x86)

- Kernel Trap (general)



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  - Virtual memory address $\mapsto$ Physical memory address
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  - Has to be done by the host OS as well as by the guest OS

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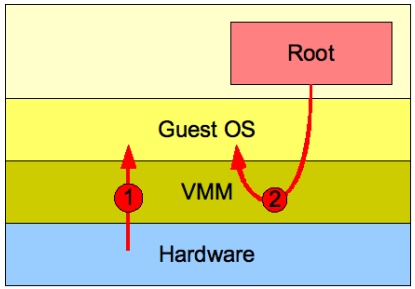

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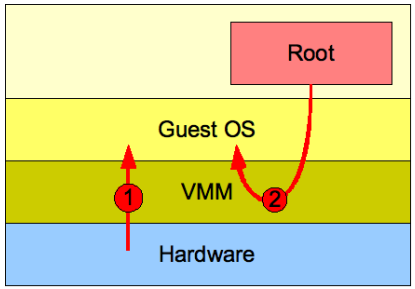

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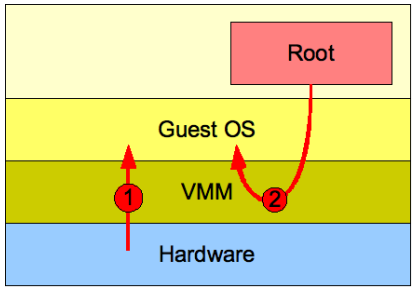

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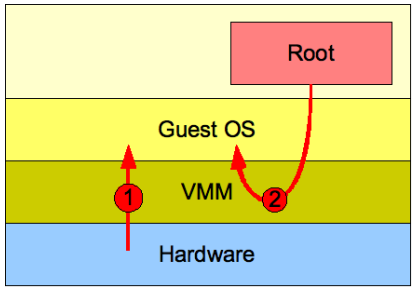

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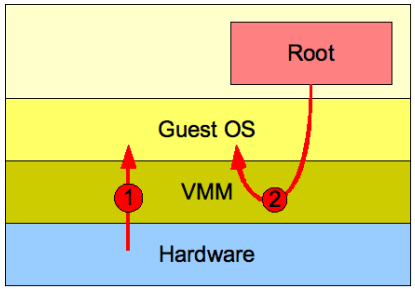

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- AliRoot v4-05-Rev-05 simulation & reconstruction
- Geant 4.9.0: simple geometry, ATLAS barrel calorimeter, CMS crystal calorimeter

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- nbench (common algorithms)
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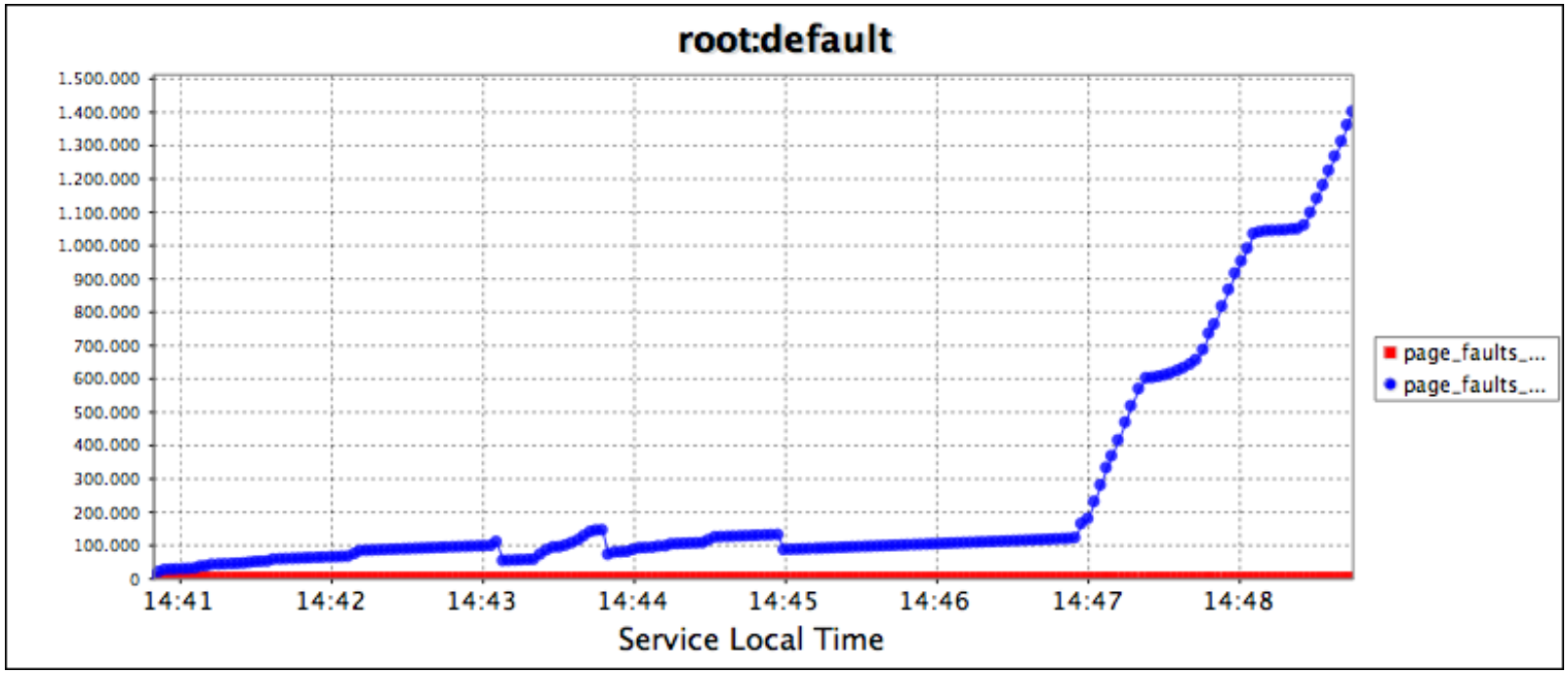
Footprints (by MonALISA)

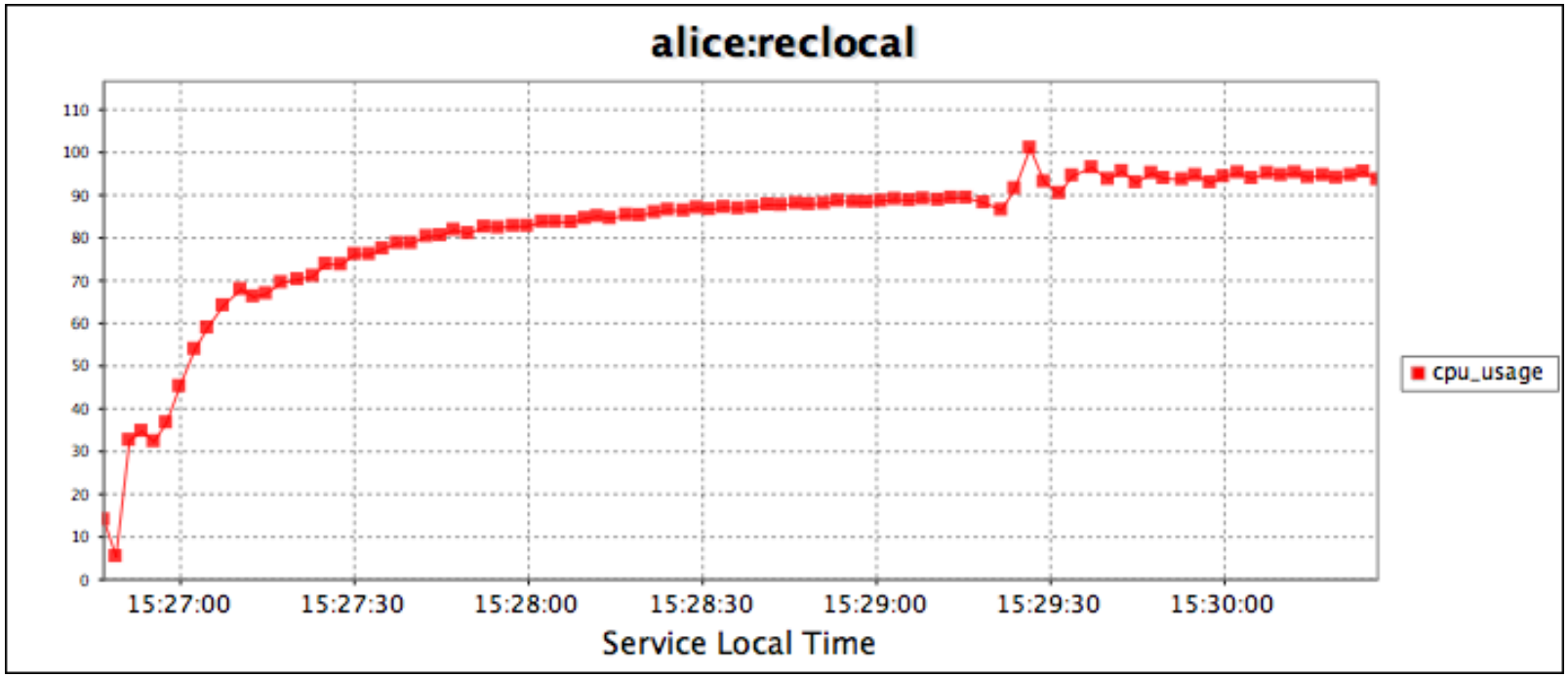
Root stressHepix Pagefaults



$\approx$ 5GB page faults, 100 – 200MB memory consumption

Footprints (by MonALISA)

AliRoot simulation and reconstruction CPU usage



$\approx$ 12GB page faults, 500MB – 1GB memory consumption

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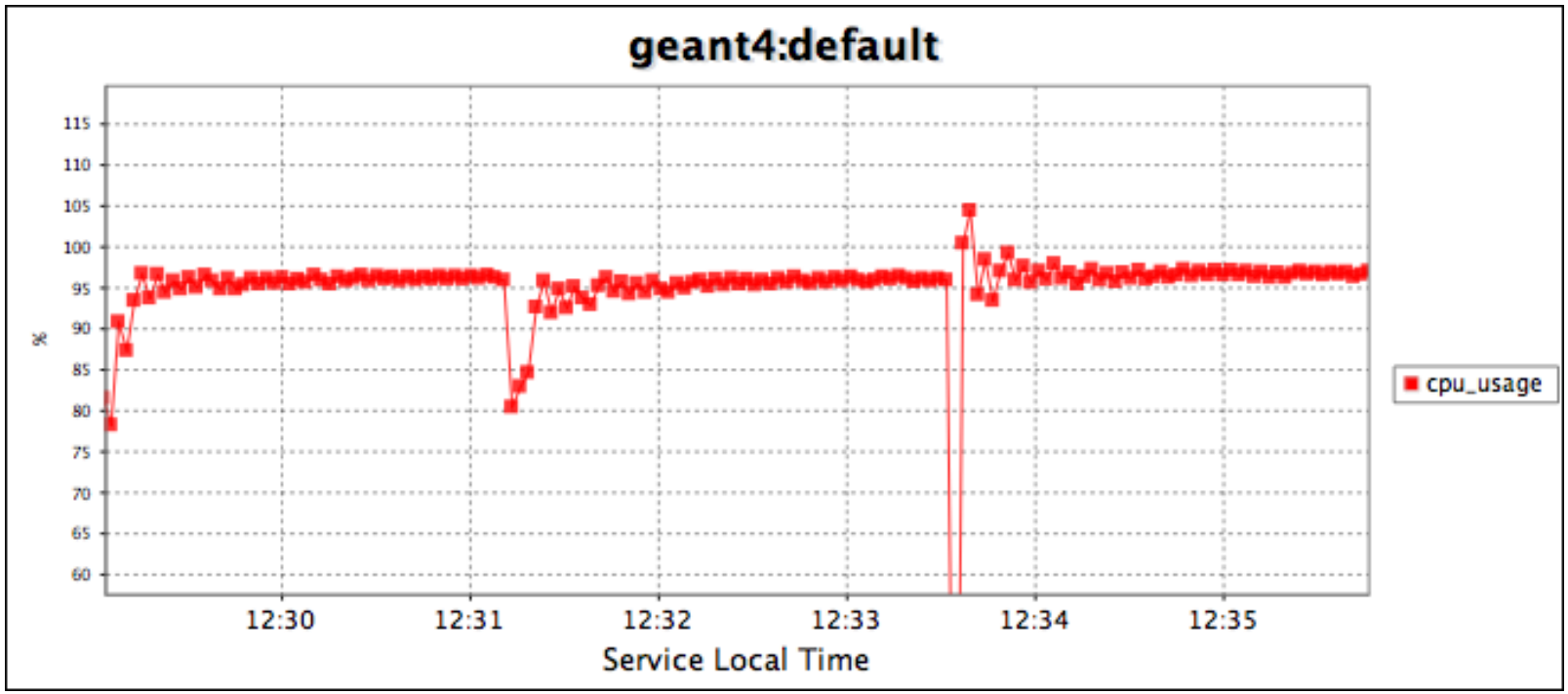
Geant4 CPU usage



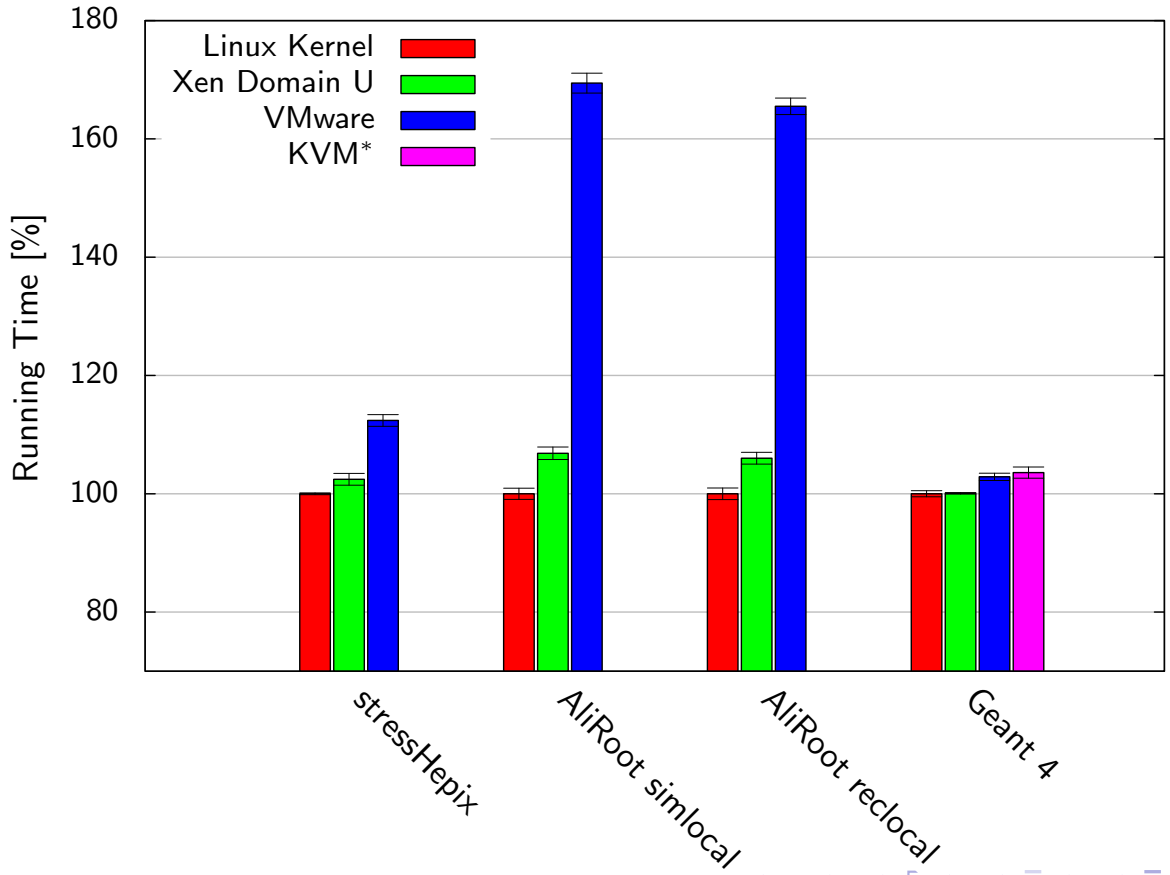
$\approx$ 500MB page faults, $<$ 100MB memory consumption

Results PC-Linux I

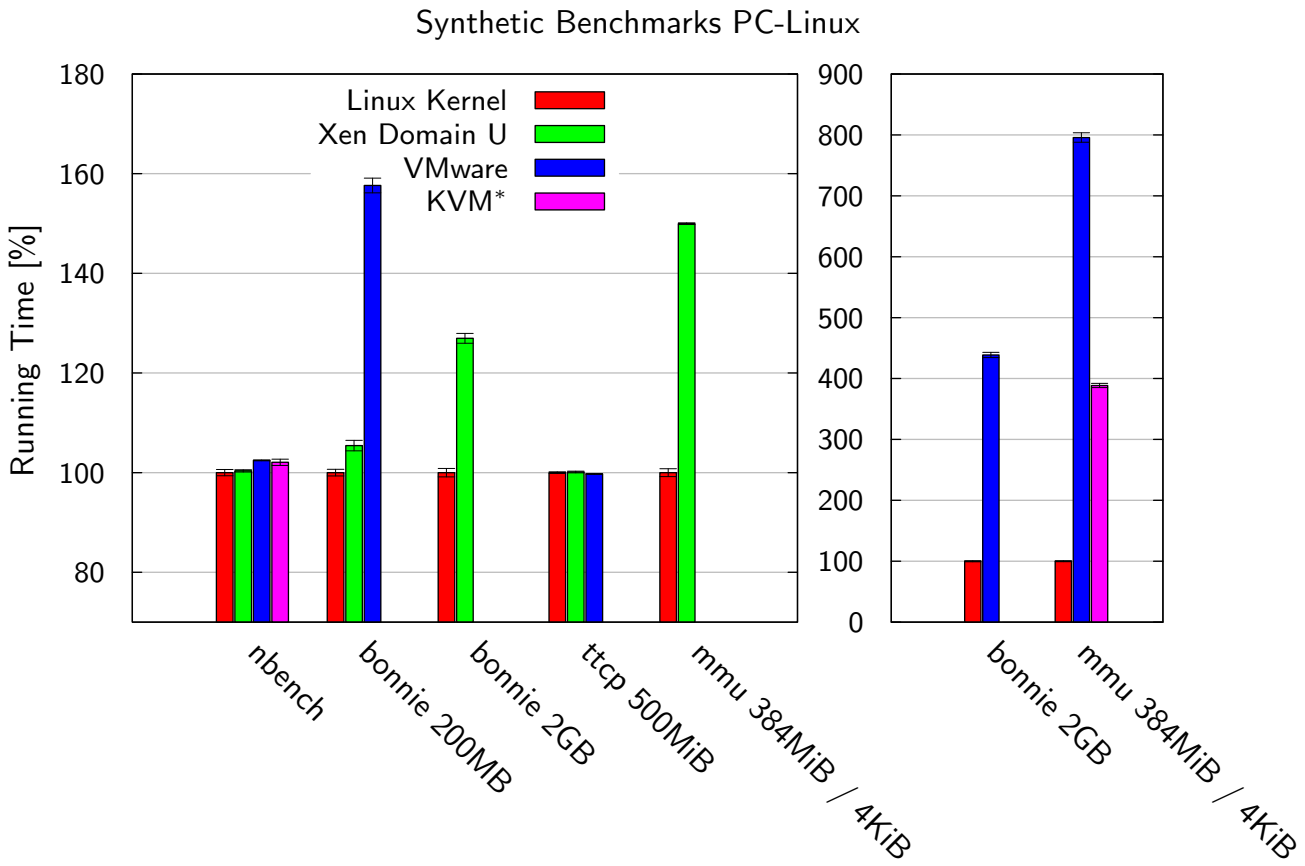
Machine: Pentium D 3.4 GHz, 2GiB RAM, 7200RPM SATA Harddrive, 100MBit NIC

Compiler is gcc in the same version for the host system and for the guest system, except for Darwin (see below)

*) There are some stability problems with KVM

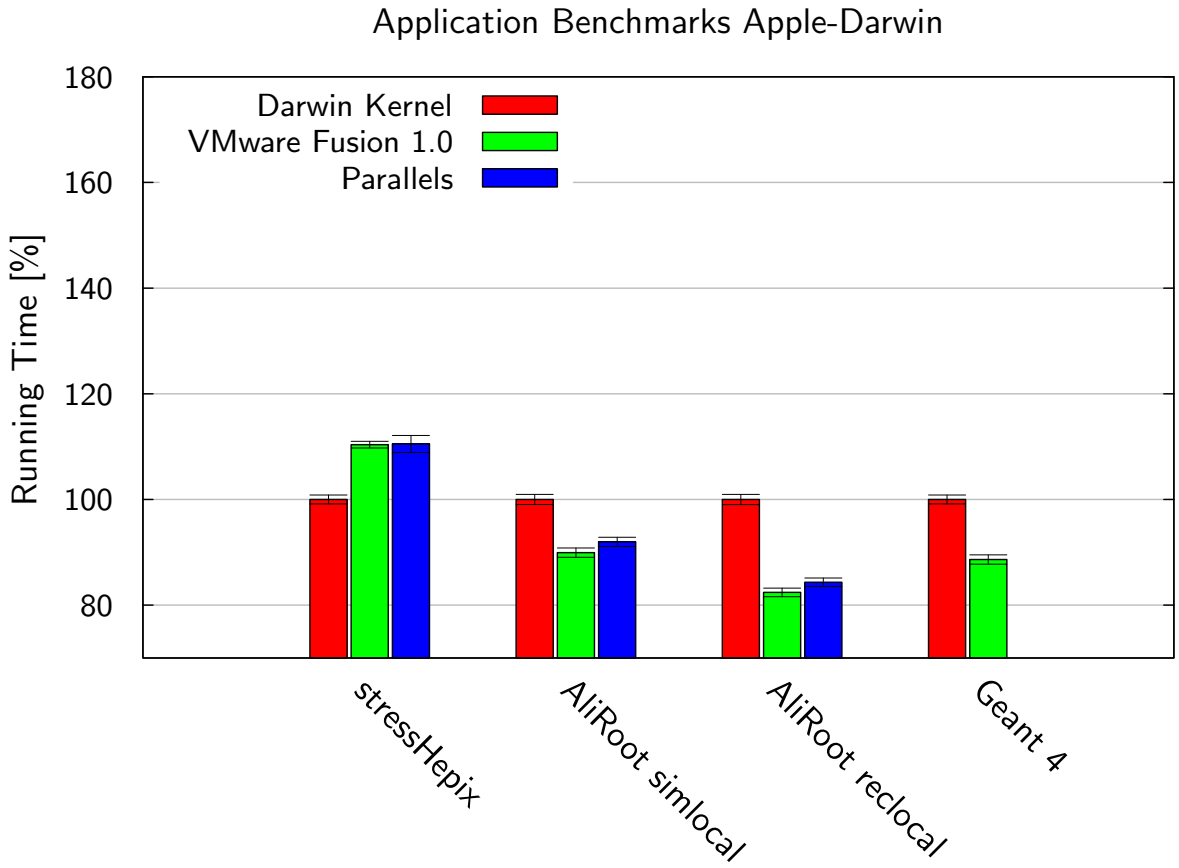


Results PC-Linux II



Results Apple-Darwin I

Machine: Intel Xeon 2GHz, 2GiB RAM, 7200RPM SATA Harddrive, GBit NIC



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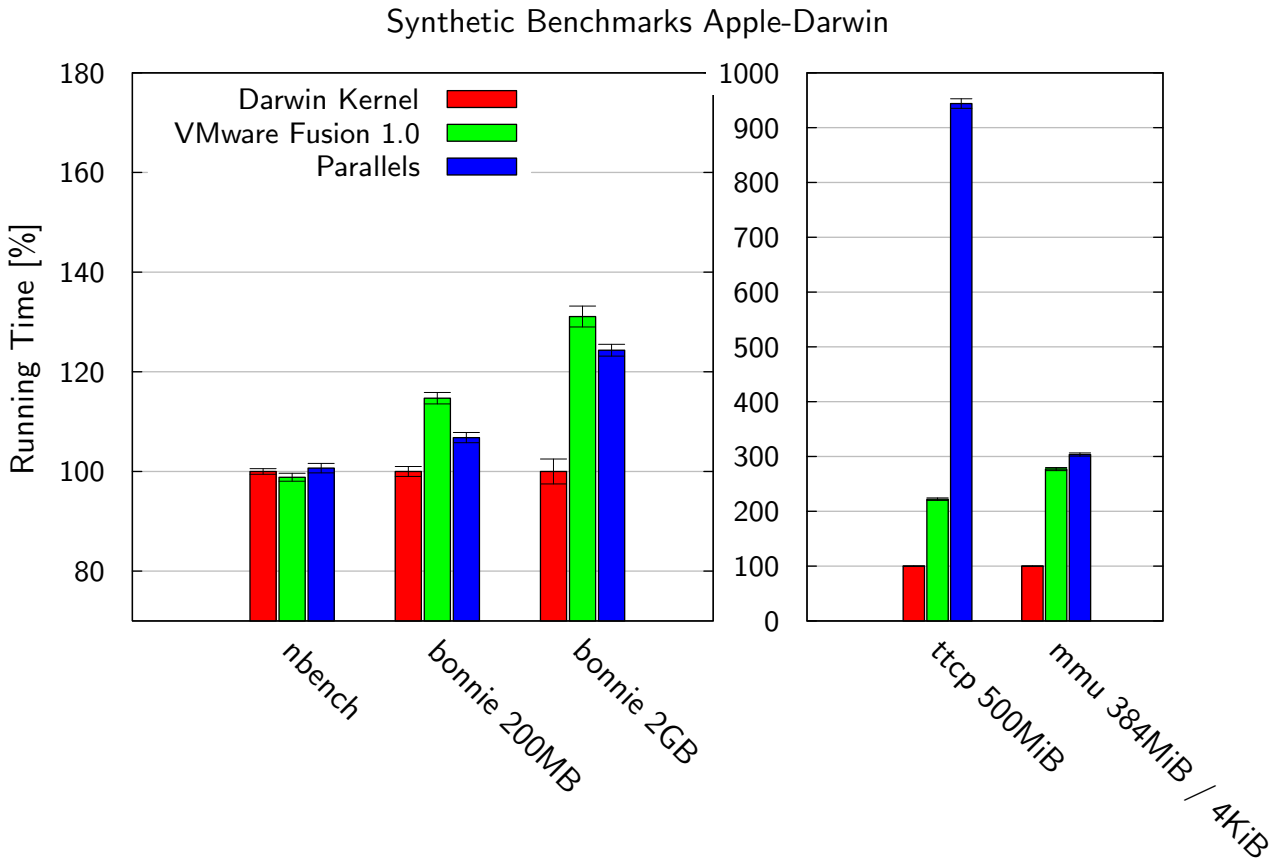

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Performance loss gcc 4.1.1 $\Rightarrow$ gcc 3.4.4: $\approx$ 20% nbench $\approx$ 10% geant4

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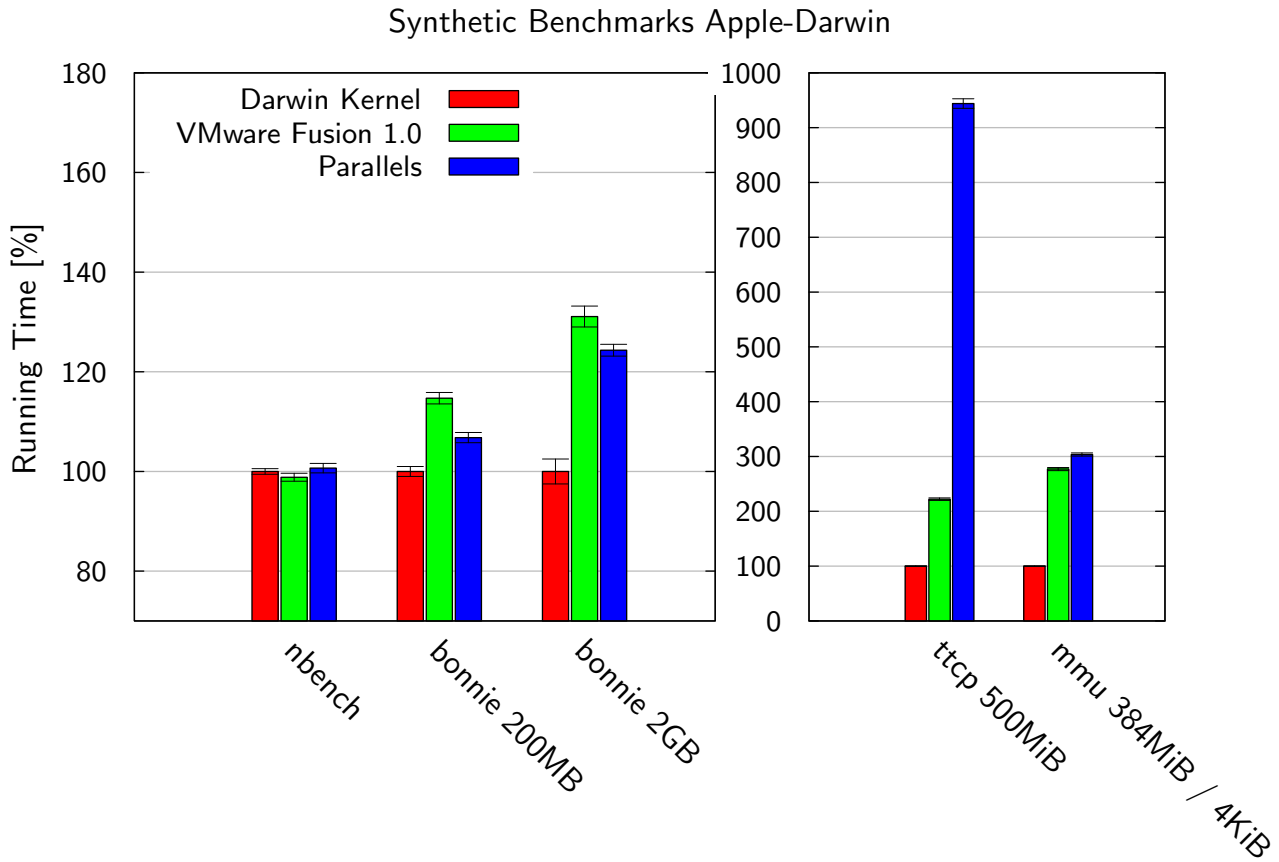

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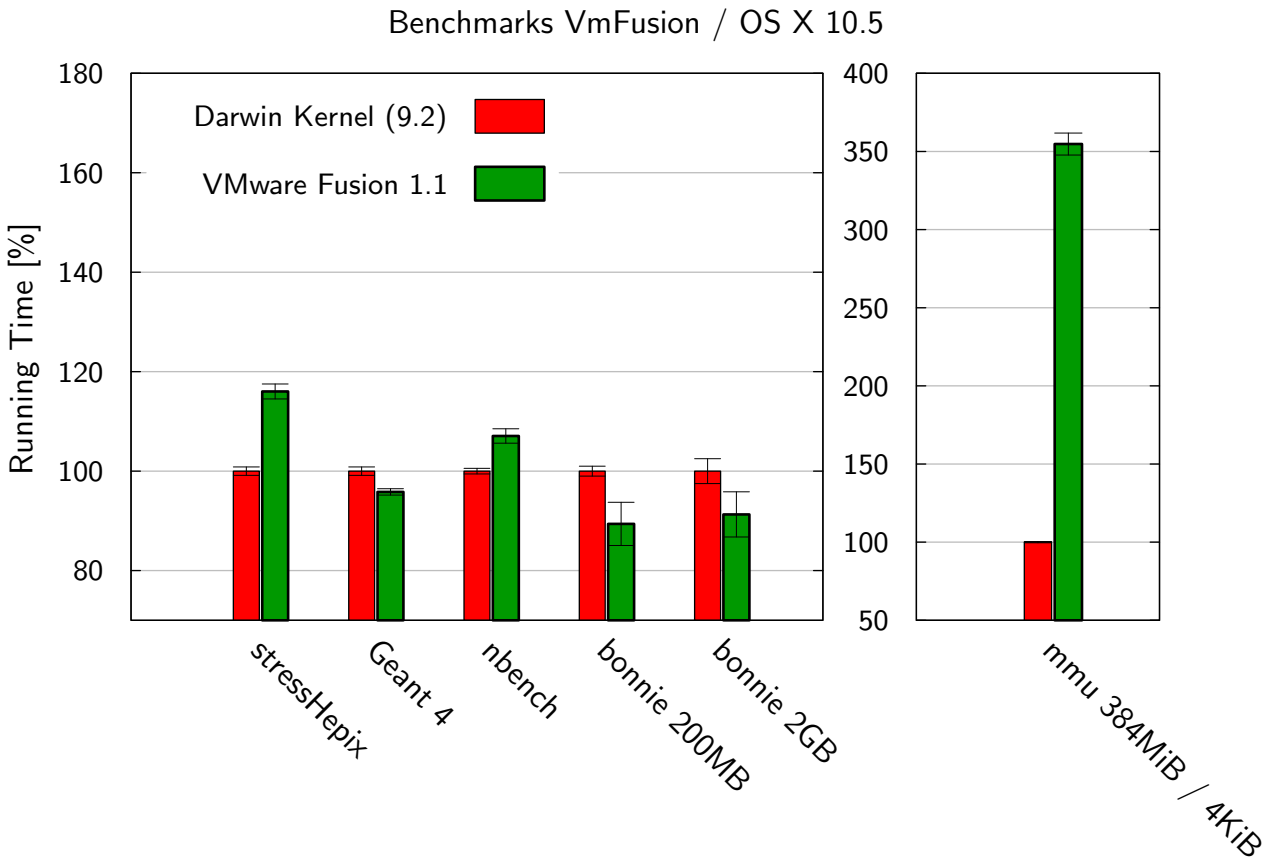
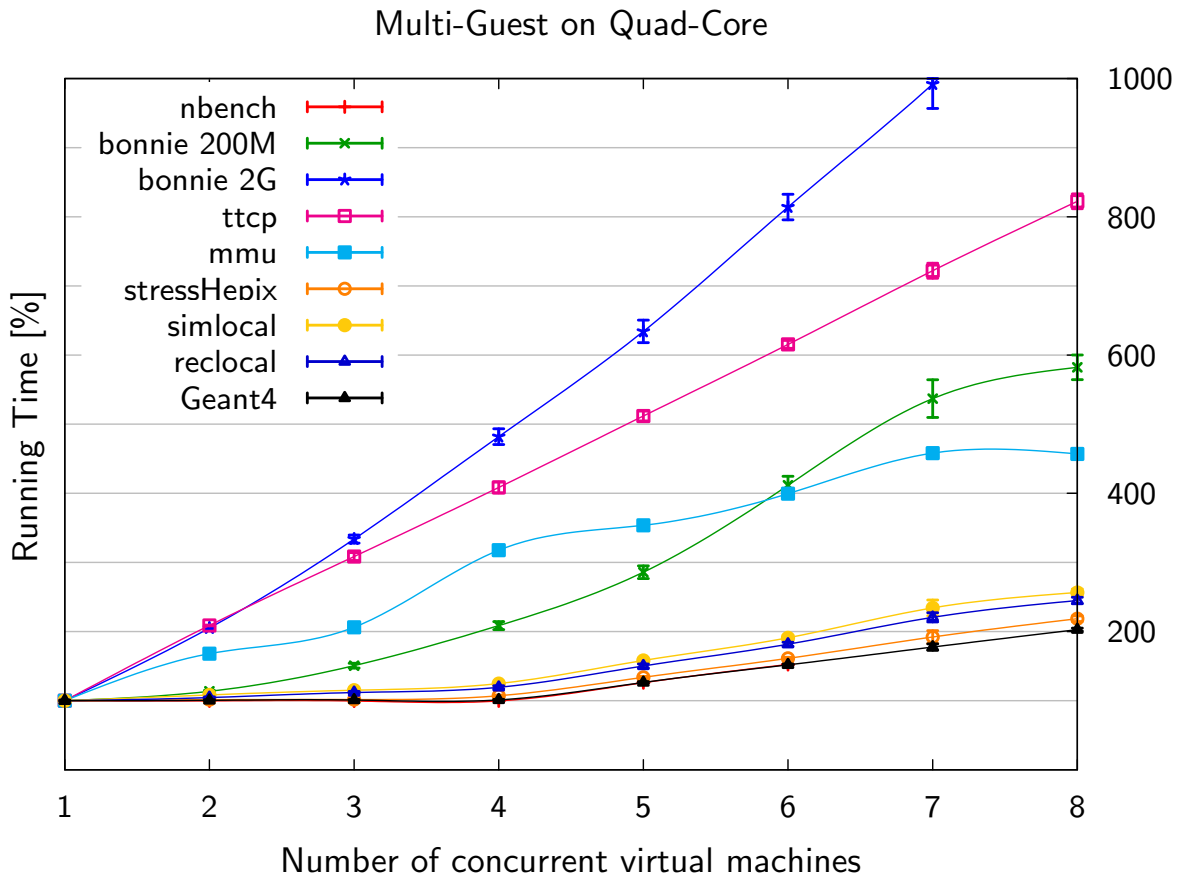
Recent Results Apple-Darwin III

Machine: Mac OS X 10.5, VmFusion 1.1, IA-32 Binaries



Multi-Guest Results

Machine: Core 2 Quad, 8GiB RAM, 4MiB 2nd Level Cache, 7200RPM SATA Harddrive



Summary: Expectations & Difficulties

User's viewpoint: No installation, robust application, encapsulated tasks

Developer's viewpoint: focus on *one* architecture, fine-tuned (modified) OS

VM Property	How to deal with
Sandbox	ssh, web application, mountable harddisk image
Multiple VMMs around	Building tools, e. g. *rBuilder*
Harddisk consumption	Lightweight Linux $\approx$ 100MB (compared to 900MB AliRoot)
Memory consumption	64Bit Host, Leightweight Linux $\approx$ 100MB resident in memory
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- VMware allows to set only MAC addresses of their own [00:50:56:00:00:00] - [00:50:56:FF:FF:FF]
- Linux on Parallels
- Moving disk images between VMMs
- VMware license restricts the publishing of benchmark results
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VMware Server	1 003 seconds
KVM	1 004 seconds
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- VMware allows to set only MAC addresses of their own [00:50:56:00:00:00] - [00:50:56:FF:FF:FF]
- Linux on Parallels
- Moving disk images between VMMs
- VMware license restricts the publishing of benchmark results
- 1 000 seconds inside virtual machines. . .

Xen DomU	1 000 seconds
VMware Server	1 003 seconds
KVM	1 004 seconds
VMware Fusion	1 000 seconds
Parallels	1 041 seconds

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HEP Applications in Virtual Machines

Jakob Blomer

April 15th 2008

(Benchmarks of Summer 2007)