VirtualPower - Notes

Matei Zaharia

November 13, 2007

Problem

• Reducing consumption of data center applications in the presence of virtualization.

• Challenges include coordination among VMs, multiple VMs per physical machine, and heterogeneity in hardware capabilities and power characteristics, which cannot be exposed directly to the VMs if migration must be supported.

Related Work

• Reducing power used by specific components for single applications.

• Putting machines to sleep (coarser-grained than VirtualPower).

Approach

• VPM (VirtualPower Management) states - ‘soft’ virtualized power states exposed to the VM regardless of underlying hardware. Hide away heterogeneity.

• VPM channels: transport VM power state requests to controller.

• VPM rules: policies determining how to respond to VMP state change requests.

• VPM mechanisms: encapsulate hardware power management capabilities.
  – Hardware scaling.
  – Soft scaling: reduce task time slices to induce idle periods, which use less power.
  – Consolidation: migrate VM’s to make entire cores and machines idle.

• Sample rules implemented: local min and smoothed min, local throttling, local planning based on workload history, and global consolidation.
Evaluation

- Use synthetic transactional benchmarks and RUBiS application, with power measured directly at the outlet.

- Experiments performed:
  - Evaluation of soft scaling (can it simulate the required performance downgrade?).
  - Power reduction from combination of hard and soft scaling.
  - Power throttling.
  - Planning for large future load in a queued-request environment.
  - Consolidation of VM’s to induce idle or sleep states.
  - Consolidation onto power-efficient hardware.

Criticisms

- 34% gain from consolidation onto Core processor is artificial – due more to efficiency of the Core platform rather than to VirtualPower.

- Tests involving larger data centers and applications with more tiers would be interesting. An ideal test would be retrofitting an existing data center with VirtualPower.

- Little consideration of cost and frequency of migration in consolidation-based policies.