An Energy Case for Hybrid Datacenter

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Goal

- Building energy efficient datacenters without sacrificing performance level

Hybrid Approach

- Low-power systems
  + High performance systems
- "Accelerators"

Evaluation

Name	Xeon L5420	Atom 330	Atom N270
Frequency Cache	2.5GHz 2x6MB	1.6GHz 2x512KB	1.6GHz 512KB
CPU Cores/CPU Threads	2 4 1	1 2 2	1 1 2
RAM	16GB	2GB	1GB
Storage	15k SAS	5.4k SATA	SSD

Platforms under Test

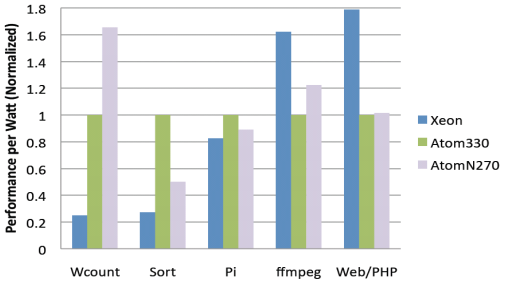
Hybrid datacenters have the potential to achieve the goal

Future work

- Explore design options
  - Discrete systems
  - Add-ons
  - Heterogeneous cores
- Planning and Scheduling

1. Performance per Watt

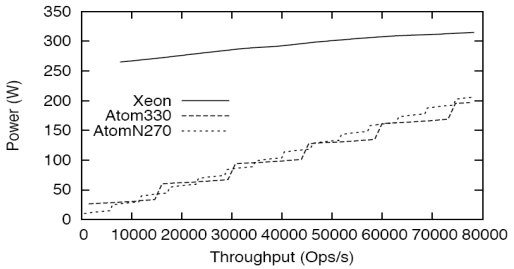
- Single solution cannot satisfy the wide range of applications



Performance per watt of the platforms across different workloads

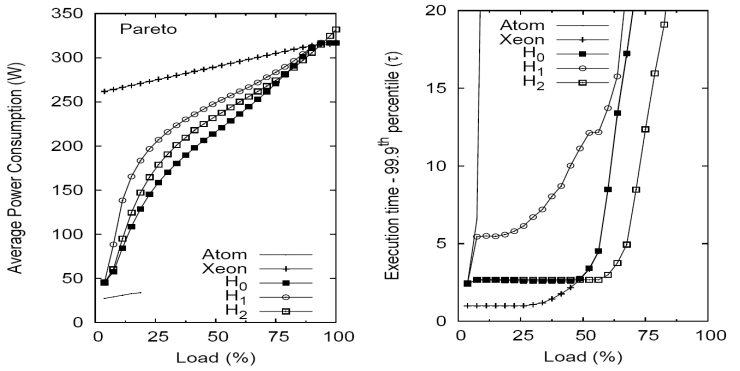
2. Energy Proportionality

- Poor scaling of power-consumption
- Set of low-power platforms can mimic energy proportional system



Throughput vs. power under SPECpower (Results from Atom platforms are extrapolated)

3. Temporal characteristics of workload



Example of H_2 operation

Hybrid solutions can
- Keep low latency
- Be energy proportional

Power consumption and 99.9th percentile of execution time with various task arrival distribution

- Atom/Xeon – single platform
- H_0 – task migration w/o cost
- H_1 – task migration w/ cost
- H_2 – no task migration

(X… …kes up at heavy-load)