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Electrical and CPU power comparisons

CC-IN2P3
Lyon – FRANCE

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Context

- Heat problems during summer
- Electrical needs always increasing
- Cooling requierements increasing

$\rightarrow$ to reduce power needs for a given CPU power

$\Rightarrow$ comparisons requiered between computers (before buying...)

Measures - definition

Electrical power:

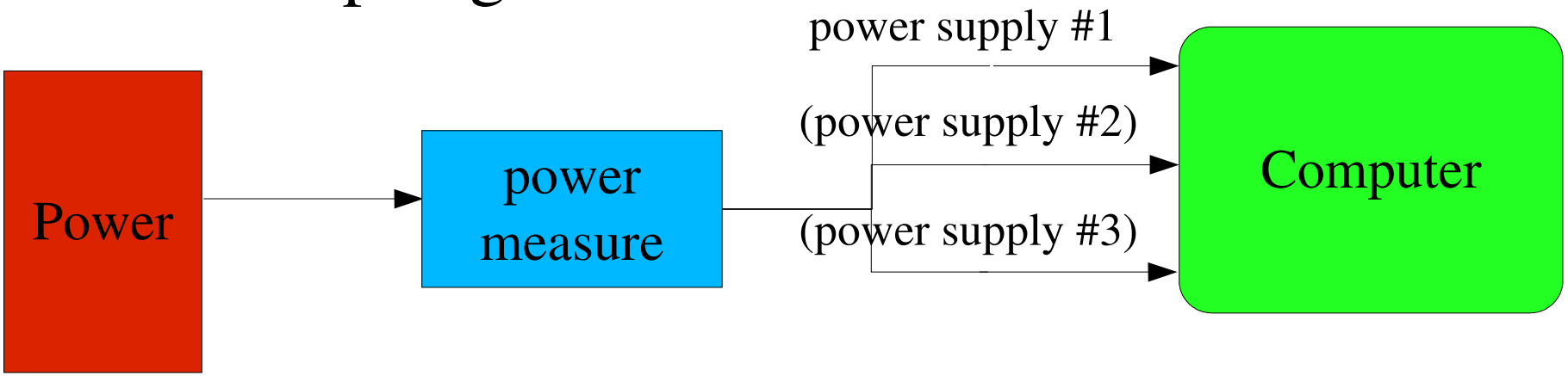
- without load
- with CPU load
- with I/O and CPU load ←

CPU power:

- one CPU/core power
- global CPUs/cores power ←

Electrical power

Direct amperage measurement:



Final value is the inforced average value of at least 5 measures taken at different moments.

CPU power

A Representative set of CPU instructions (integer, floats, math, memory access...)

Designed to prevent cache effects

⇒ defines a CPU power “unit”, used to compare computers.

⇒ coherent with our BQS CPU power measures

Comparisons – electrical power

A (old) computer is the reference:

→ it gets a 1.0 value for electrical and CPU power

→ a machine with a value of 2.0 needs two times more electrical power

→ a machine with a value of 0.5 need two times less electrical power

Comparisons – CPU power

Comparison with the same (old) computer:

computed value is the electrical power needed to compute a CPU power "unit"

→ a machine with 2.0 needs two times more power

→ a machine with 0.5 needs two time less power

(so it is not an efficiency but a inefficiency measure)

Computed values

Following values was computed (not all shown):

- the instant electrical needs at full load (W/s)
- the electrical needs per computer and per year (kW)
- the CPU power delivered by the computer (full load)
- the electrical efficiency for a given CPU power
- electrical cost for a 3-years time
- corresponding cooling systems cost
- ...

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Tested computers

- NEC1: Nec Re120 2xIntel HT 2.8Ghz - 2Go
- NEC2: Nec Re120 2x Intel HT 3Ghz - 2Go
- NEC3: Nec RA2500 2xOpteron 275 dualcore -8Go
- NEC4: Nec RA2500 2xOpteron 280 dualcore - 8Go
- IBM1: x335 2xIntel 2.4GHz HT - 2Go
- IBM2: x336 2xIntel 3GHz HT (2 alims) - 2Go
- IBM3: x336 2xIntel 3GHz HT (1 alim) - 2Go
- IBM4: e326 2xOpteron 250 - 2Go
- IBM5: Lame LS20 2xOpteron 275 dualcore - 8Go
- SUN1: Sun v20z 2xOpteron 275 - 2Go
- SUN2: Sun v20z 2xOpteron 275 dualcore - 2Go

Type	W full usage	CPU power	power efficiency	Conso 1 y (W)
NEC1	324,3	1,34	0,96	2801
NEC2	312,8	1,45	0,85	2680
NEC3	273,7	2,4	0,45	2357
NEC4	299	2,61	0,46	2599
IBM1	253	1	1	2176
IBM2	425,5	1,45	1,15	3627
IBM3	374,9	1,45	1,02	3224
IBM4	253	1,29	0,77	2156
IBM5	204,7	2,4	0,33	1733
SUN1	299	1,18	0,94	2418
SUN2	264,5	2,39	0,43	2216

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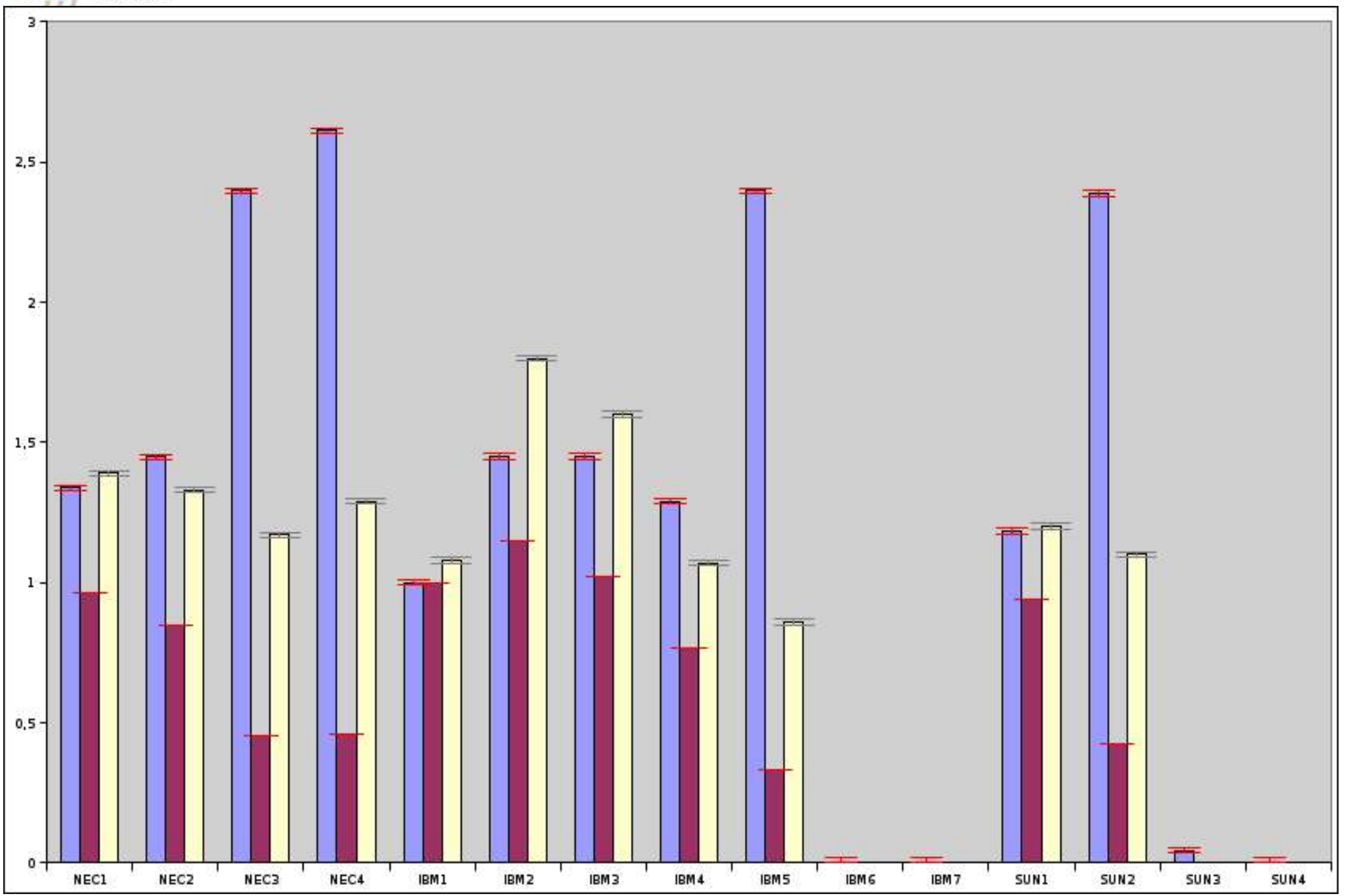

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Conclusions

For the tested machines:

- Opteron better than Xeon (CPU and power)
- Dualcore better than HyperThreading
- One power supply better than two or more
- Big companies (IBM, Sun) better than smaller
- Blades systems better than others

For the future

- To test more computers (Intel dualcores)
- To test other blade systems
- To include heat generation in the measures

A note on costs

- machine price + maintenance
- cost for electrical power (i.e. 3 years)
- cost for cooling systems (electrical)
- cost for racks (if not included)
- cost for network equipements
- in some cases, “cost” of the space used in computer room


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