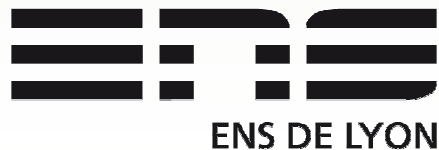


Hemera challenge : Energy profiling of large scale applications

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Hemera Kick Off, Paris, October 5, 2010



How to decrease the energy consumption without impacting the performances?

- How to monitor and to analyze the usage and energy consumption of large scale platforms?
- How to apply energy leverages (large scale coordinated shutdown/slowdown) ?
- How to design energy aware software frameworks ?
- How to help users to express their Green concerns and to express tradeoffs between performance and energy efficiency ?

The Green Grid5000

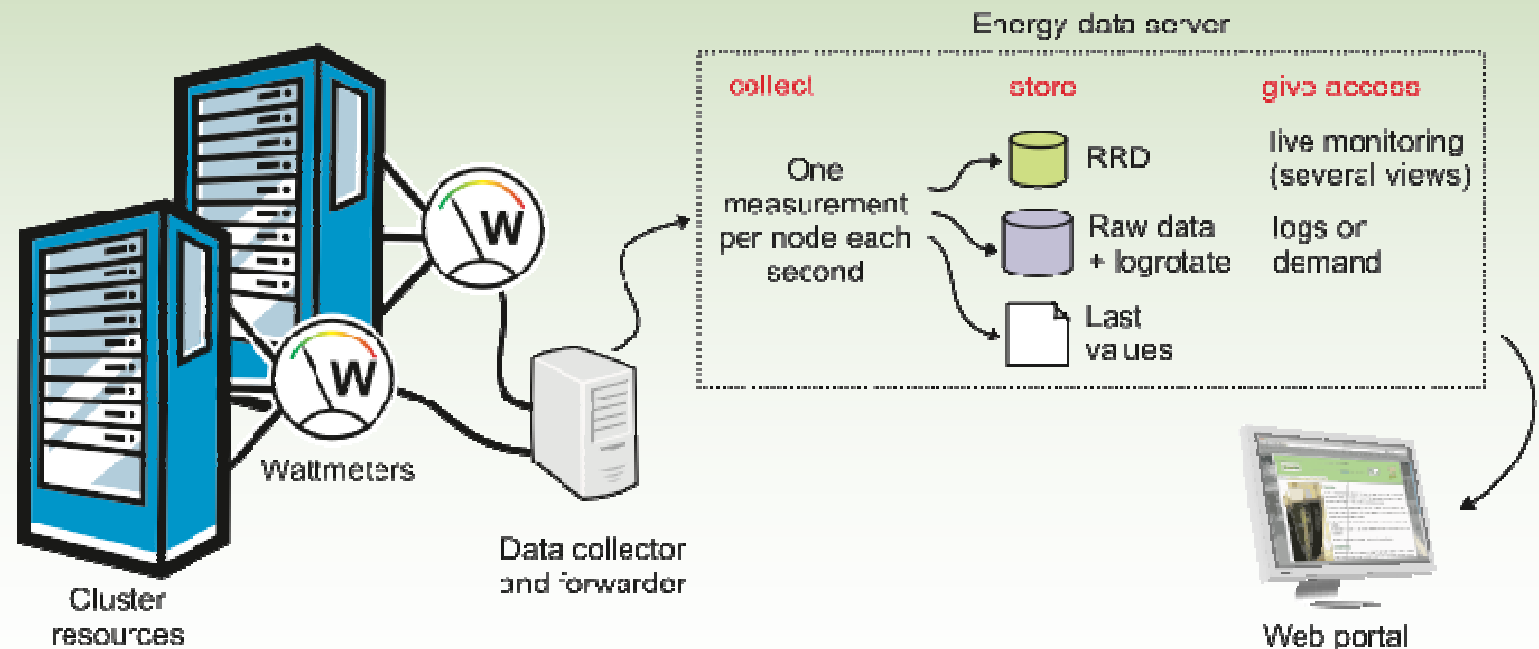
Energy sensors

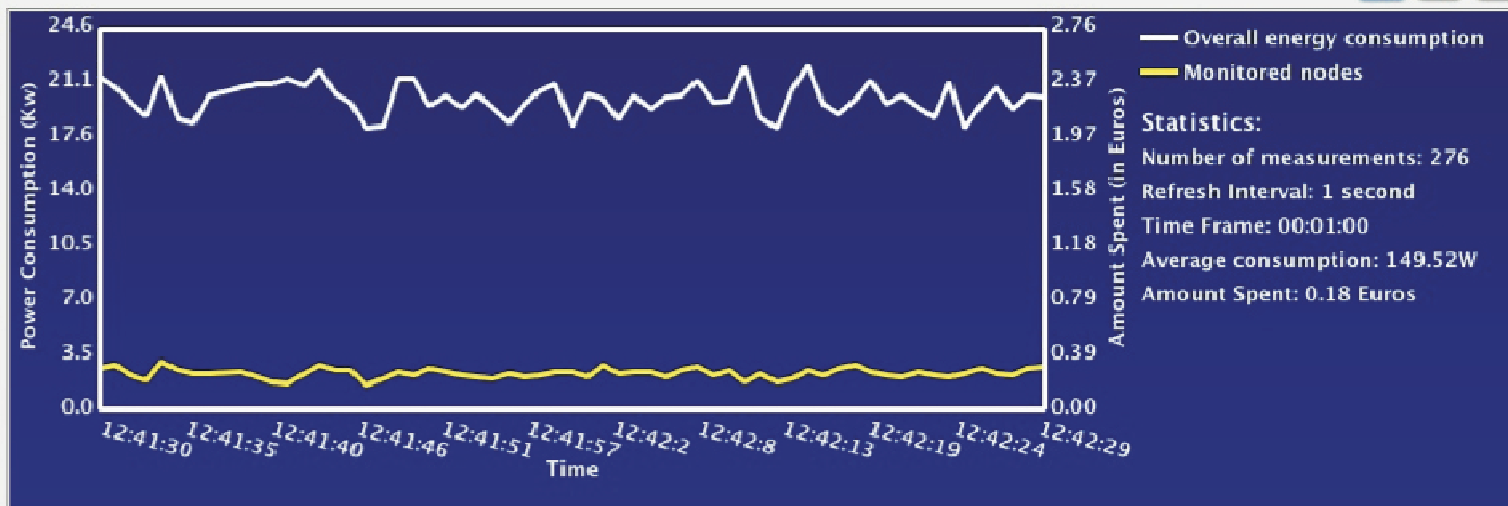
6 or 48 ports, communication via serial port

Deployed on three sites of Grid'5000

Library for **interfacing** with **energy sensors**

Client-side applications to **obtain** and **store** the energy consumption data

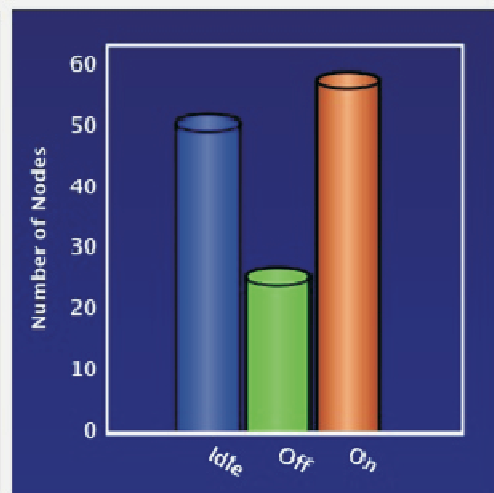




Status of Resources:

sagit-1 74.81W ●	sagit-11 294.94W ●	sagit-21 221.42W ●	sagit-31 163.69W ●	sagit-41 43.65W ●	sagit-51 193.71W ●	sagit-61 236.40W ●	sagit-71 64.54W ●	capric-2 241.65W ●	capric-3 186.97W ●	capric-4 130.27W ●	capric-5 83.97W ●	capric-6 180.02W ●
sagit-2 162.28W ●	sagit-12 276.10W ●	sagit-22 19.56W ●	sagit-32 274.28W ●	sagit-42 55.37W ●	sagit-52 73.74W ●	sagit-62 189.81W ●	sagit-72 203.15W ●	capric-3 192.85W ●	capric-15 52.98W ●	capric-25 14.16W ●	capric-43 130.27W ●	capric-53 226.64W ●
sagit-3 253.17W ●	sagit-13 257.72W ●	sagit-23 74.62W ●	sagit-33 10.06W ●	sagit-43 118.46W ●	sagit-53 220.34W ●	sagit-63 214.84W ●	sagit-73 133.10W ●	capric-7 72.71W ●	capric-16 70.33W ●	capric-26 261.25W ●	capric-44 130.27W ●	capric-54 40.37W ●
sagit-4 290.73W ●	sagit-14 32.88W ●	sagit-24 203.23W ●	sagit-34 225.22W ●	sagit-44 8.775W ●	sagit-54 245.74W ●	sagit-64 199.51W ●	sagit-74 234.59W ●	capric-8 177.11W ●	capric-17 14.22W ●	capric-27 12.46W ●	capric-45 130.27W ●	capric-55 43.12W ●
sagit-5 11.05W ●	sagit-15 84.01W ●	sagit-25 40.13W ●	sagit-35 298.92W ●	sagit-45 89.05W ●	sagit-55 245.91W ●	sagit-65 36.89W ●	sagit-75 29.49W ●	capric-9 22.22W ●	capric-18 14.22W ●	capric-28 246.45W ●	capric-46 130.27W ●	capric-56 171.48W ●
sagit-6 199.85W ●	sagit-16 87.00W ●	sagit-26 121.88W ●	sagit-36 166.51W ●	sagit-46 142.07W ●	sagit-56 69.71W ●	sagit-66 142.63W ●	sagit-76 55.75W ●	capric-10 113.88W ●	capric-19 13.43W ●	capric-29 13.43W ●	capric-47 130.27W ●	capric-57 171.48W ●
sagit-7 167.38W ●	sagit-17 103.75W ●	sagit-27 259.07W ●	sagit-37 285.37W ●	sagit-47 214.58W ●	sagit-57 289.71W ●	sagit-67 95.29W ●	sagit-77 287.10W ●	capric-11 180.02W ●	capric-20 13.43W ●	capric-30 13.43W ●	capric-48 130.27W ●	capric-58 171.48W ●
sagit-8 12.01W ●	sagit-18 221.81W ●	sagit-28 36.93W ●	sagit-38 213.72W ●	sagit-48 12.82W ●	sagit-58 47.50W ●	sagit-68 244.97W ●	sagit-78 150.37W ●	capric-12 203.09W ●	capric-21 13.43W ●	capric-31 13.43W ●	capric-49 130.27W ●	capric-59 171.48W ●
sagit-9 153.28W ●	sagit-19 69.04W ●	sagit-29 201.03W ●	sagit-39 77.61W ●	sagit-49 2.38W ●	sagit-59 298.60W ●	sagit-69 25.05W ●	sagit-79 37.01W ●	capric-13 113.88W ●	capric-22 13.43W ●	capric-32 13.43W ●	capric-50 171.48W ●	
sagit-10 137.56W ●	sagit-20 216.04W ●	sagit-30 207.96W ●	sagit-40 129.01W ●	sagit-50 223.91W ●	sagit-60 244.97W ●	sagit-70 14.47W ●	capric-1 86.08W ●	capric-11 215.51W ●	capric-23 13.43W ●	capric-33 13.43W ●	capric-51 171.48W ●	

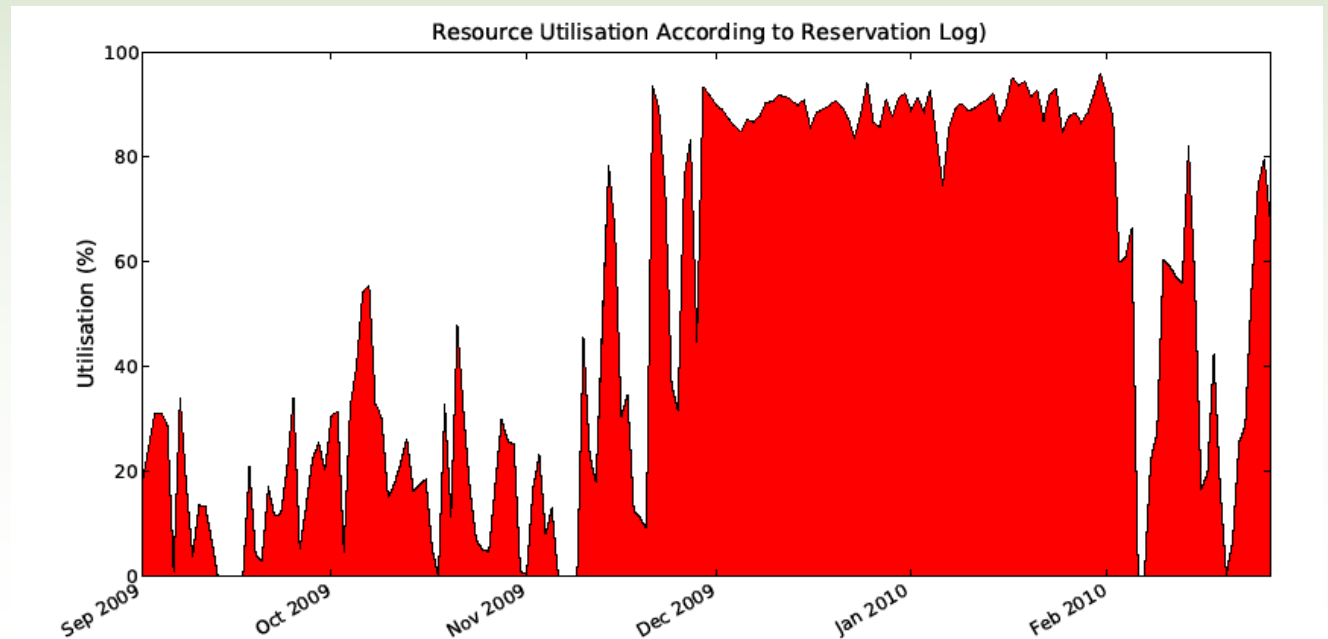
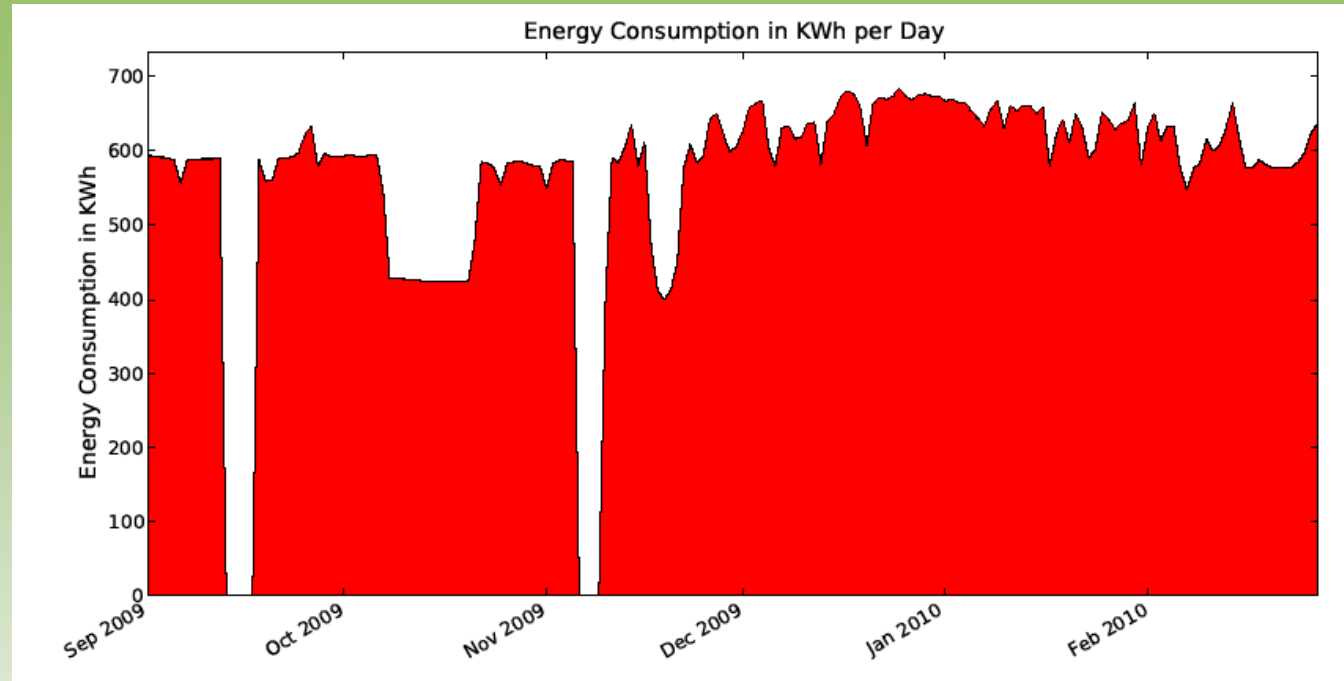
■ Resource on
 ■ Resource idle
 ■ Resource off
 ● Resource monitored



Electrical consumption / Usage

Periodicity of energy measurements:

One measurement per **second** for each equipment



*

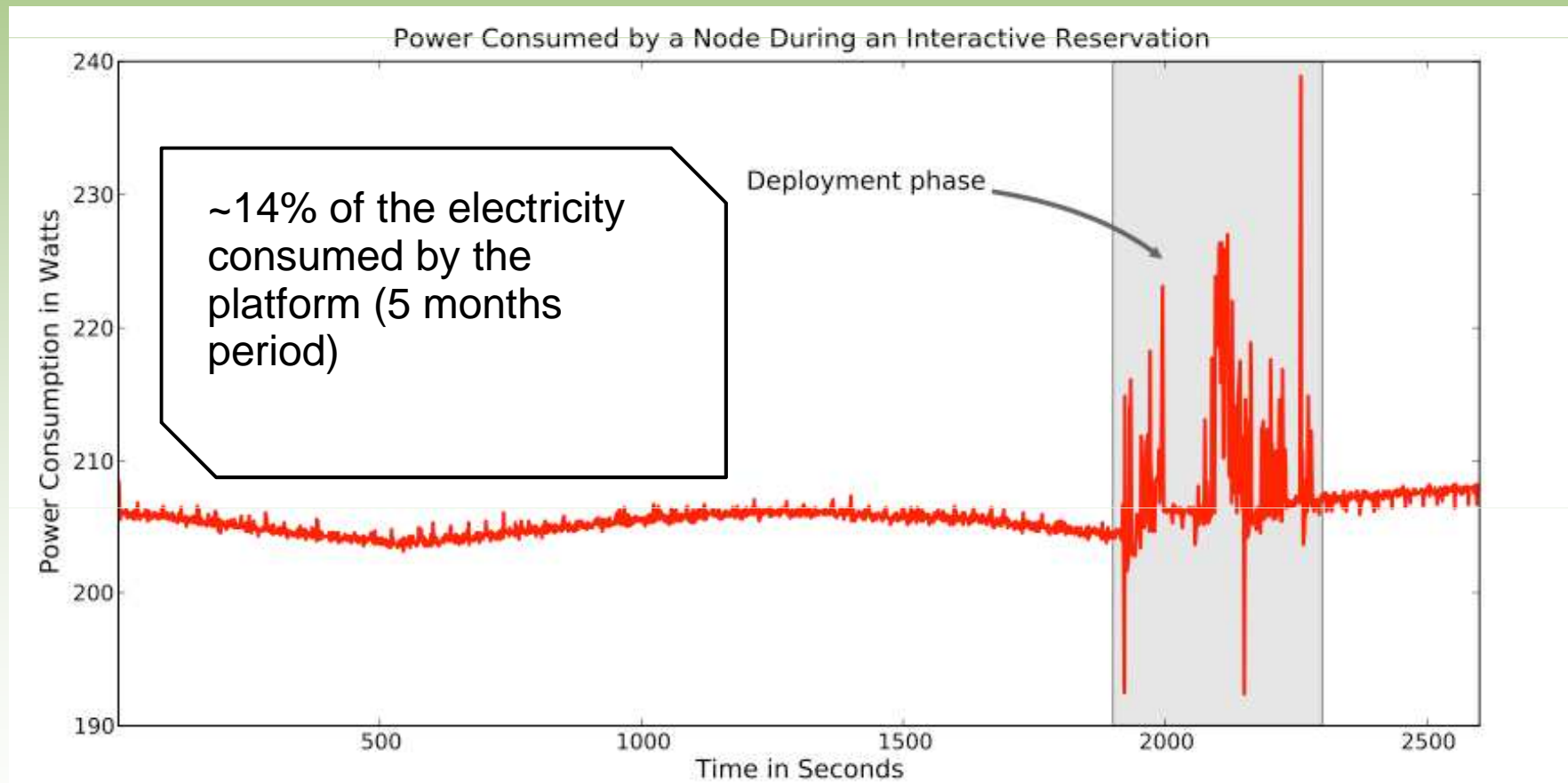
Energy Profiling of applications

Profiling the energy consumption of applications



Detecting anomalies

Improving frameworks/middleware and policies



A.6 Challenge

- Exploring energy aspects at large scale
- 2 focus :
 - Applications deployed on real physical resources
 - Applications and services deployed on virtualized resources
- Providing feedback on large scale applications
- Extending the Green Grid5000
- Analyzing energy usage of large scale applications per components
- Designing energy proportional frameworks (computing, memory or network usage)



Hemera 1st year

- *“Energy profiling and green leverages for services and applications in large scale distributed systems”*
- Joint Phd (INRIA RESO – IRIT)
- Study and Design of benchmarks for service and HPC oriented
- Inject energy in SLAs
- Exploring autonomous learning modules « *try & observe & react* »
- Study of energy leverages



Impact on Grid5000 / links

- Large scale energy monitoring platforms – Green POP - Grid5000 development team / metrology
- Links with Interface Action on energy profiling on production infrastructures / European COST action
- Looking for applications

- Questions ?

