



# Renewable Energy Aware Data Centres: The Problem of Controlling the Applications Workload

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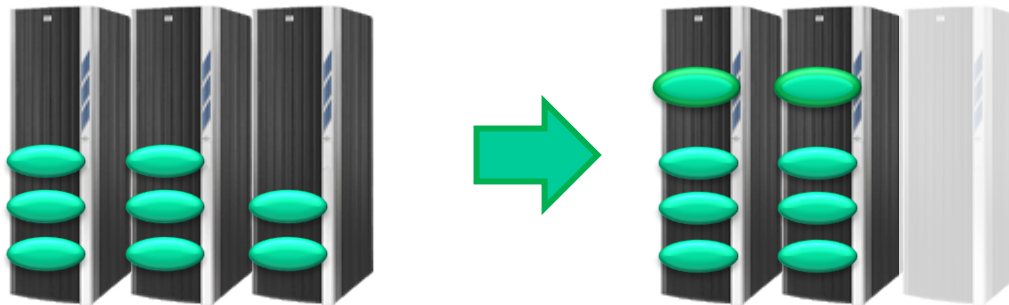
E2DC workshop, Berkeley, 20/05/13



- **Introduction**
- **State of art**
- **The problem**
- **Possible architecture and technologies**
- **Conclusion**



- **How to save energy?**
  - **Use virtualization and VM migration**
- **How to better use renewable energies?**
  - **Schedule workload when renewable energy is available**
  - **Store energy (batteries...)**



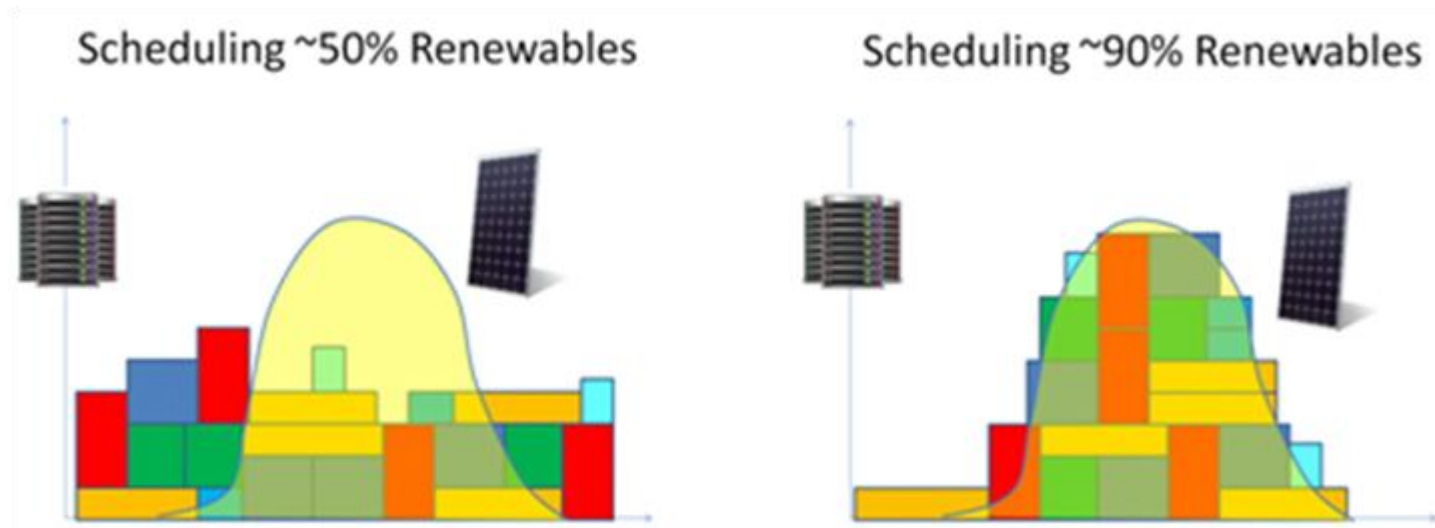
Final objective: allow energy aware algorithms to perform better energy savings



- **Energy aware algorithms in DC management frameworks**
  - Energy-aware (re)allocation of VMs
- **Advanced distributed computing paradigms**
  - Hadoop, GreenHadoop
  - GreenSlot
  - Scala's Swarm
  - Cloud Haskell
- Application profiles
  - Amazon EC2
  - HipSpec



## How to understand the load of applications?



- Increase the use of renewable energies
- => Necessity to shift in time the workload of some applications in the data centre
- => Difficult: applications unaware of self workload, unable to predict the required computing power
- => Different time scales



- The applications need to be more “self-aware”
- The applications need to externalize some of its workload

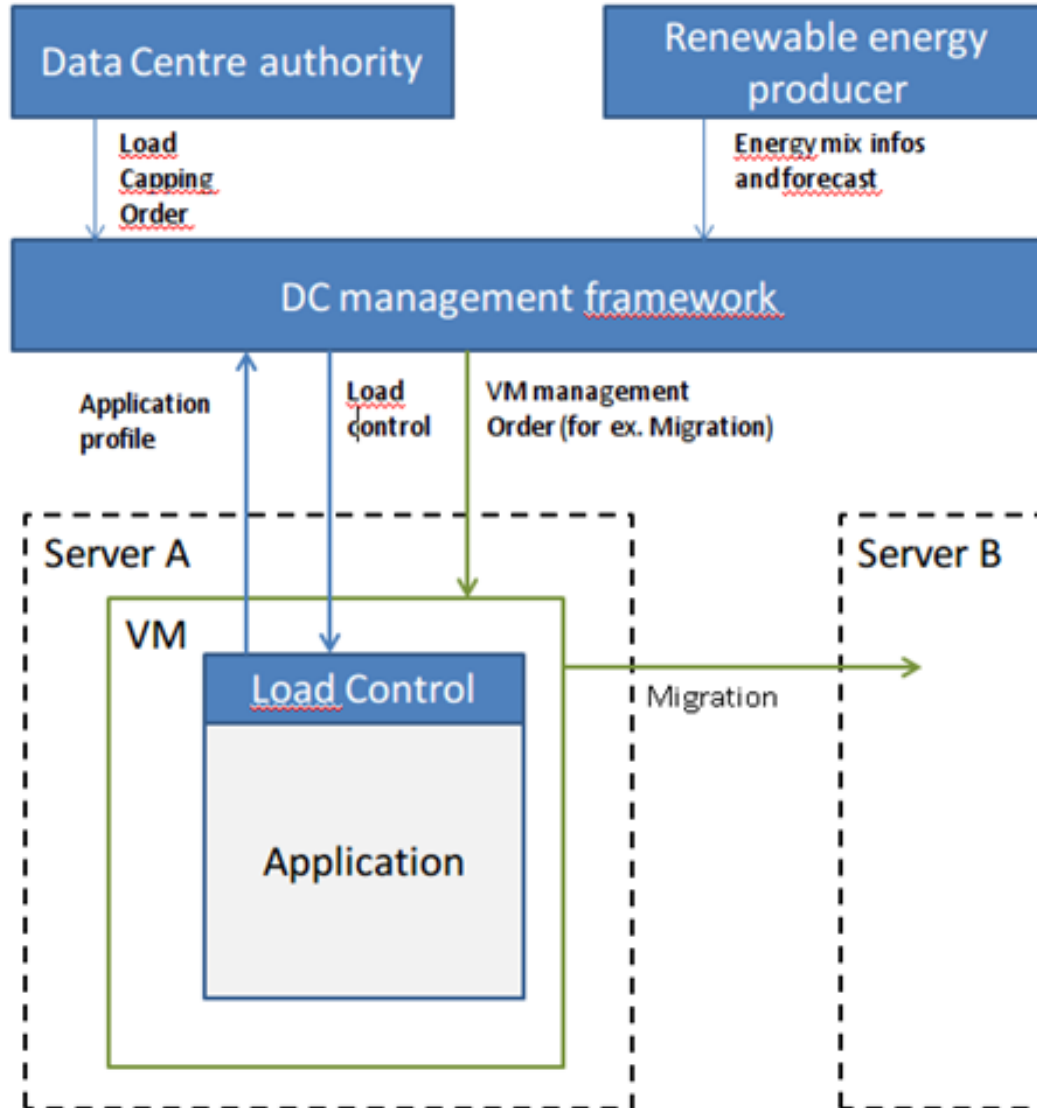
But...

- Applications communicate very few information back to the OS
- The granularity of the virtualization in a Cloud DC is low



## Components to develop:

- Format and protocol for applications profiles
  - own needs in term of resources
  - possible performance trade-offs and uncertainty ranges
- Library to extract the application profiles
- DC framework able to read the application profiles
  - consolidate and schedule the applications
- Library to allow an external process to control the application load







- Automatic, Semi-automatic or Manual extraction?
  - Historical data
  - Instrumenting the code
  - Proof of complexity: HipSpec



# Conclusion

- To better exploit renewable energies, we need application profiles
- We presented a preliminary architecture and research directions to:
  - Extract the app profile
  - Transmit it
  - Exploit it
  - Control the workload