Low-carbon distributed solution for RO in the cloud

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Abstract

As digital transition of companies and countries appears to be a critical development lever, the environmental impacts of the growing numerical sector must not be underestimated. According to The Shift Project [2], the energy consumption of digital technologies has been constantly increasing during the past few years to reach 4% of global greenhouse gas emissions in 2019. Developing the cloud seems to be a key to sharing resources and mitigating the environmental impact. However, to keep up with the expanding need for computational power, ever stronger processing units are produced and ever bigger data centers are built inducing more energy consumption to power and to cool the hardware.

Operations Research is concerned by these environmental issues as some classes of optimization problems are very demanding in computing resources and can be solved efficiently in the cloud. Qarnot computing provides a green alternative solution with detailed reports on each source of power expense and a comparison with traditional centralized data centers to assess the carbon footprint reduction due to the decentralized approach.

To reduce the greenhouse gas emissions of the cloud, Qarnot Computing is promoting a new paradigm in which computers are considered as machines that produce both computation and heat [1]. The fatal waste heat of servers, incorporated in boilers (see Figure 2), is reused to heat housings, offices or warehouses of an edge-computing grid (see Figure 1).

This geo-distributed data center is operated by a scheduler matching computing and heating needs raising specific Operations Research problems. The scheduler enforces an adaptive heat-aware scheduling approach. It needs to meet the daily and seasonal changes in the heat demand on different host sites while satisfying operational constraints such as honoring the Service Level Agreement (SLA) with both clients (compute and heat) or preserving the hardware from overheating. Strategies including increasing or reducing the frequencies of the processing units are studied to tackle this particular scheduling problem.

Figures

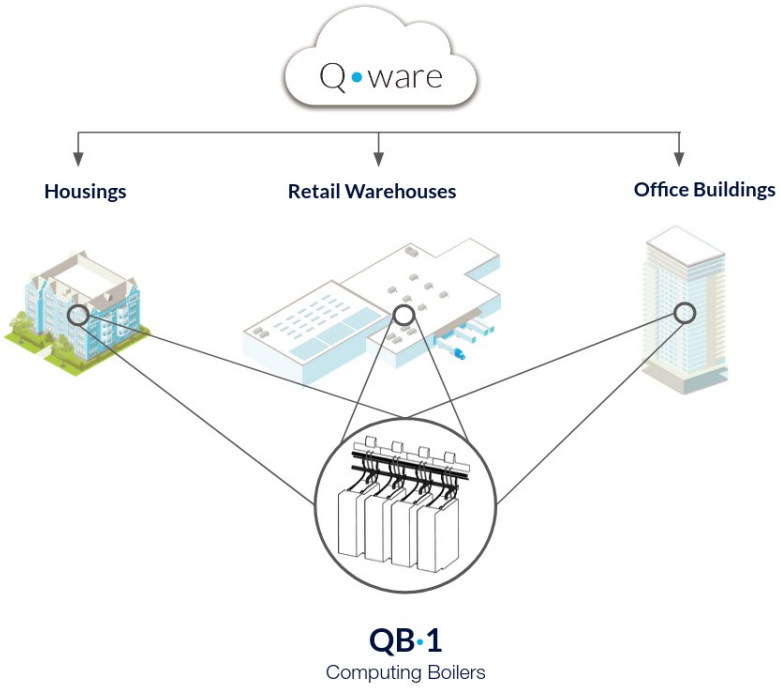

FIG. 1 – Qarnot architecture

FIG. 2 – Qarnot digital Boiler (QB1)

Références

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