Fraunhofer SCAI

Leibniz Supercomputing Centre of the Bavarian Academy of Sciences and Humanities

IBM

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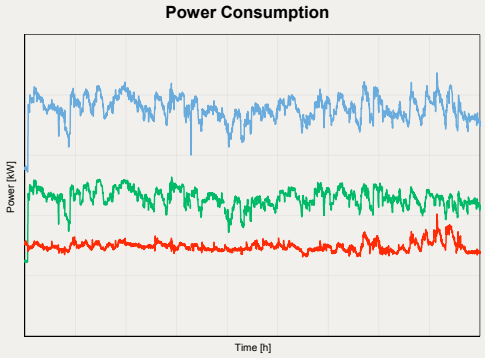
FRAUNHOFER INSTITUTE FOR ALGORITHMS AND SCIENTIFIC COMPUTING SCAI



1 *The building of the BAdW-LRZ in Garching.*

2 *Power consumption of the data center.*

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SIMOPEK

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SIMULATION AND OPTIMIZATION OF DATA CENTER ENERGY FLOWS

The reduction of energy consumption and the possible reuse of waste heat become increasingly important issues in the design and operation of large data centers. The increased variability in the energy consumption of HPC data centers is a great challenge for the current center infrastructure, which is mainly driven by the need to save electrical energy.

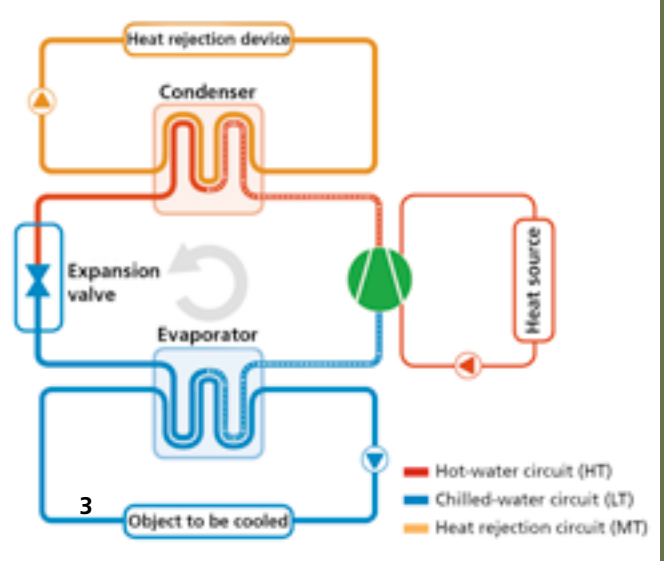
Figure 2 shows the power consumption of the Leibniz Supercomputing Centre of the Bavarian Academy of Sciences and Humanities in Garching (LRZ). As can be seen, the overall power consumption varies with the power consumption of the super computer (SuperMUC). The combination of this load variability and the use of new cooling technologies in the data center (chillerless cooling) provides an opportunity to increase the energy efficiency of the data center.

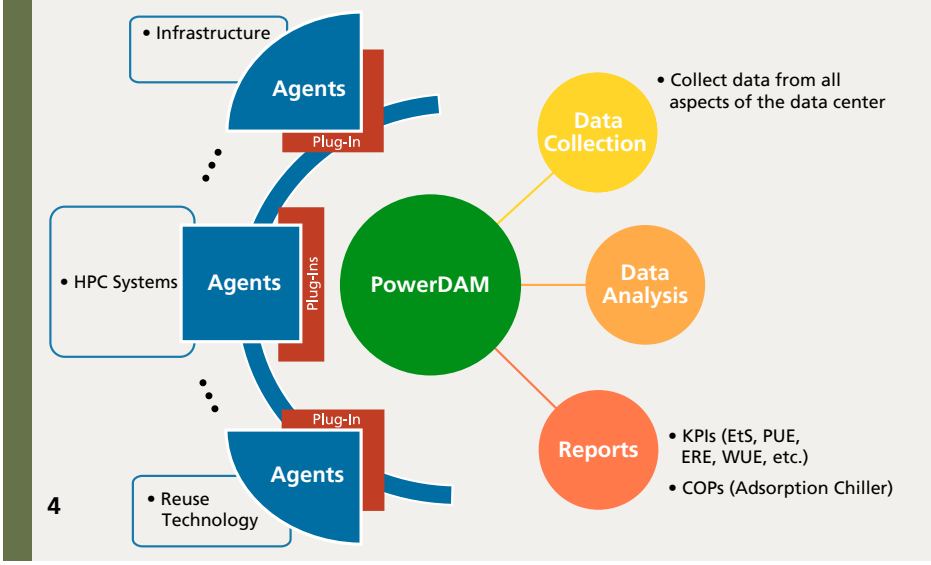
The main objective of the project SIMOPEK, funded by the German Federal Ministry of Education and Research (BMBF), is to model, simulate and optimize the energy efficiency of centers, starting with the LRZ, using a holistic approach.

The LRZ and the Fraunhofer SCAI will develop methods and software components for modeling, simulating and optimizing the energy flow network of a data center. The model will take into account both the highly dynamic load behavior of the HPC system, inovative cooling technologies (high-temperature liquid cooling – IBM), as well as new concepts for waste heat reuse (adsorption cooling – SorTech AG).

For simulating and optimizing data center energy flow networks, SCAI's software MYNTS is extended appropriately. Models of novel SorTech adsorbers (see Figure 3 for their functional setup) are built up and their configuration is optimized for the specific project scenarios.

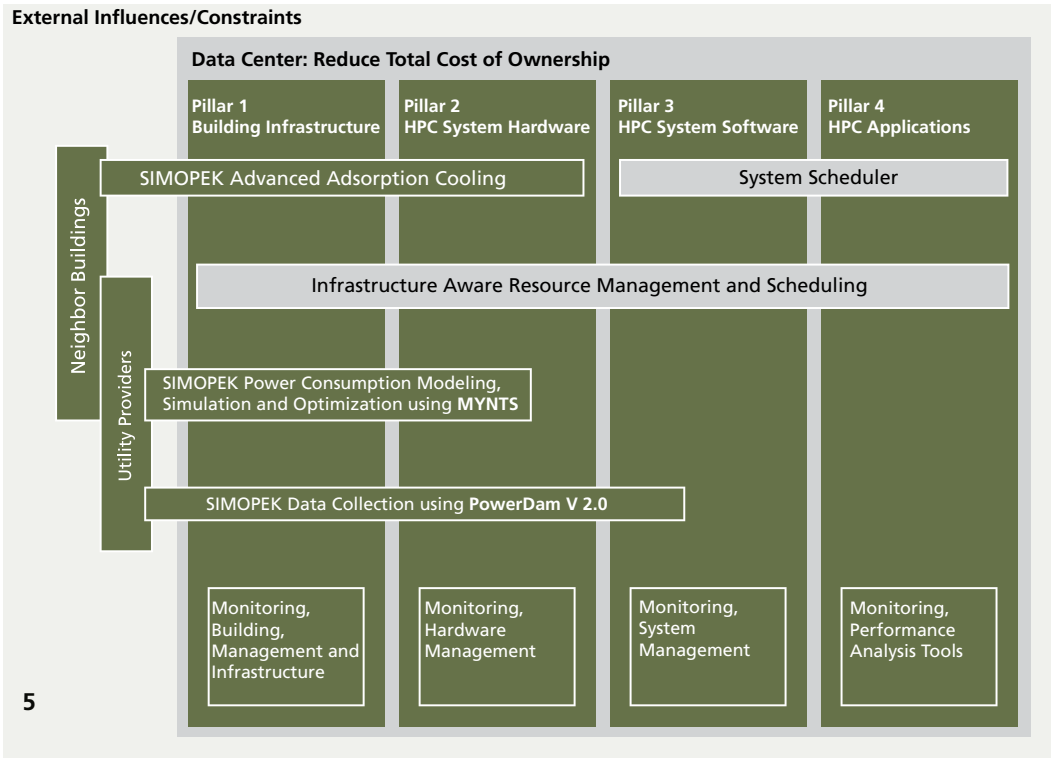
LRZ will provide operational data from both





the data center infrastructure (cooling and electrical circuit) and the installed super computer SuperMUC (power consumption and job information). To that end LRZ extends its Power Data Aggregation Monitor (PowerDAM) to be able to collect data from the LRZ building automation system (Johnson Controls) and the power management system (Siemens WinCC) and to feed them into MYNTS. Figure 4 shows a conceptual overview of the PowerDAM tool.

Another part of the project SIMOPEK is the development of concepts to allow the use of project results and software for other data centers with special focus on the Gauss Centre for Super-Computing and the Gauss Allianz. It is also envisioned that SIMOPEK will be used to support the planning of future data center infrastructures taking into account future features of HPC systems, different cooling technology options, and te heat reuse technologies.



3 *Schematic representation of the cooling circuits of the data center.*
4 *Conceptual overview of the Power Data Aggregation Monitor.*
5 *SIMOPEK as further step to move towards the proposed vision for the LRZ HPC data center.*

Stand: 06/2014