AC4DC – Adaptive computing for dynamic data centers

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Today in the area of cloud-computing data centers take an ever growing share of energy consumption of Information and Communication Technology (ICT). The energy efficiency of data center components has been continuously increased over the last years, but the energy consumption is still expected to grow further. The demand for IT services increases faster than power consumption can be reduced by the current efficiency improvements. Furthermore isolated optimized individual systems and sub-optimally used capacities are some of the main causes of the high levels of energy consumption for ICT.

The project AC4DC develops methods to drastically reduce this energy demand by optimizing the operation of ICT systems as a whole, including terminals, data centers, data networks and energy providers in terms of energy demand and total costs. The consequent holistic view of the system not only creates extensive possibilities of energy saving but also enables a load optimization in power networks, especially in smart grids. The project partners are developing an intelligent load and infrastructure management system, which should increase energy efficiency by involving every stakeholder – from the supplier to the user.

To accomplish the project's aims, intelligent forms of load-management in data centers, infrastructure and data storage are researched. These are applied to single data centers as well as to a cluster of multiple data centers. This three-step approach partially enables the parallel achievement of the project's aims. The concepts developed will then be implemented as prototypes and tested in partly isolated environments. This is then used to evaluate the energy saving potential. The optimization also reflects influences such as user behavior, economic requirements and site-specific parameters. The systematic and early involvement of data center operators assures the project's market-orientation. In addition highly-effective business models and potentials to save energy and material will be identified.

In cooperation with the project partners BTC is significantly involved in multiple work areas of the project. Analyses of existing data as well as the accomplishment of new measurements in data centers are an essential part to be able to make statements
about the energy demand of servers and complete data centers. This also includes the development of new measurement technologies.

In addition new models are developed and evaluated which allow for a proactive controlling and sharing of services across servers and data centers. These models also take into account the cooling system, power supply, backup and the associated monitoring systems. General algorithms are developed for controlling in the context of dynamic system management.

Finally an implementation of a prototype of the system will be developed and used to prove that the results are also relevant in practical use.

In this talk BTC will present first results of the ongoing research and development of a new green data center architecture, which will integrate the full spectrum of state-of-the-art technologies to transform data centers into more power-saving facilities.