

# **High Performance Computing, Grids and Clouds: Synergies, Trends and Challenges**

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## Abstract:

New trends in the HPC area can be derived from increasing growth-rates at the lower end of the market, specifically at the workgroup and departmental level, and from concepts which are based on the original promises of computational grids. Those trends combined with the ever increasing demand for even higher component densities and higher energy efficiency generate additional challenges: examples of new products will be shown which specifically address those issues.

An HPC product portfolio is presented that is based on standards at the processor, node and interconnect level. The strategic approach comprises a triangle with computation, data management and visualization representing the sides of the triangle. The success of such a standard-based strategy continues to be reflected in major wins across all market segments.

The TOP500 list clearly shows that Blade-based architectures are now fully established as the new standard architecture for HPC-Systems. Those systems provide vast opportunities in terms of system efficiency but will also lead to new challenges. HP's new BladeSystem c-Class has been addressing those challenges with innovative concepts in three key areas - power and cooling efficiencies, system management capabilities and virtualization. Several examples of very large implementations will be presented.

At the software and middleware level Grids have been established successfully in various dimensions and from there a new trend "Cloud Computing" is emerging. Clouds are enabled through automation and virtualization technologies that make it possible to abstract away much of the complexity of accessing vast amounts of computing and storage. Cloud providers can and will pass on the economies of scale of huge data centers through a pay per use model. Current trends, challenges and examples will be discussed and compared to classical Grid environments.