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**DATE OF DISPUTATION:** 12<sup>th</sup> of August 2014

**DISSERTATION TITLE:** *Optimized Routing for Fat-Tree Topologies*

It is not only the number and the frequency of the processors that makes today's supercomputers so immensely powerful. One of the most important aspects of every high-performance system is the interconnect - the network that connects the whole system together.

With the advent of cloud computing and big data, today's high-performance systems are facing new complex multi-layered challenges. This thesis focuses on routing and proposes multiple improvements in this area.

Thanks to the work presented in this thesis, the management of enterprise-class high-performance systems became simpler, fault-tolerance became integrated into the routing algorithms and the performance gains exceeded the expectations.

The contributions to this thesis are a set of five extended routing algorithms that build upon the original fat-tree routing presented by Eitan Zahavi. Furthermore, for the first time two advanced inter-subnet routing algorithms were presented and evaluated. The usability of these solutions is best illustrated by the fact that 3 of the presented algorithms have already found a way into all InfiniBand systems manufactured by Oracle Corporation.

This thesis has resulted in 5 conference papers, one journal paper and 7 patents. Future work has been already undertaken and will result in future papers and patents.