

# "Architecture Recapitulates Phylogeny", How Scalability Requires Specialization

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## **Abstract**

*There is an old saying in biology asserting that ontogeny recapitulates phylogeny, expressing the belief that the stages of development of an embryo, from one fertilized cell to a complete human form, mimics the steps taken by our genetic ancestors as homo sapiens evolved. There's an analogy that can be drawn between this biological assertion and the evolution of parallel processing.*

*SMPs and clusters alike have generally been configured with nearly homogeneous functionality among processors. This has limited their scalability for many large applications.*

*Recently, more specialization of purpose has crept into the roles individual nodes play in cluster configurations. As clusters are scaled further to take*

*their place as the heirs to the roles formerly played by custom-designed large-scale supercomputers, even more specialization is needed to achieve the efficiency and manageability required to perform satisfactorily on tough capability workloads in demanding production environments, in the same way cells must differentiate and specialize in larger complex organisms.*

*This talk will focus on the rise of clusters for high-performance capability computing. It will examine the forces driving natural selection in today's changing high-performance computing environment, review the architectural genetics of successful and unsuccessful precursors to today's clustered HPC platforms, and look ahead to what adaptations may be needed for clusters to successfully occupy this challenging ecological niche.*