

## Feeling Congested: Challenges in HPC Interconnect Architecture

John Kim

KAIST

[jjk12@kaist.edu](mailto:jjk12@kaist.edu)

**Abstract** – The increase in pin bandwidth has enabled high-radix topologies such as Dragonfly and HyperX in large-scale networks. While optics continue to provide high bandwidth channels, the bandwidth is only useful if properly utilized across all available network channels. For example, global adaptive routing is critical to fully exploit the path diversity of the high-radix topologies. However, a more fundamental challenge is congestion -- both in terms of properly identifying congestion and managing congestion in a large-scale networks. In this work, we address some challenges in high-radix topology congestion of high-radix topologies, including phantom congestion and indirectness in routing as well as how adaptive routing and congestion management can negatively interfere with each other. We also discuss opportunities for optics in congestion management of large-scale networks.

**Bio** – John Kim is an associate professor in the School of Computing at KAIST and currently spending his sabbatical at HP Labs. He received his Ph.D. from Stanford University and his B.S. and M.Eng from Cornell University. Prior to graduate school, John has worked on the design of several processors at Motorola and Intel. His research interest includes computer architecture, interconnection networks, and mobile systems. His work on the Dragonfly topology was selected as an IEEE Micro Top Pick and has received a Google Faculty Research Award.