

**Docket #:** S07-039

# Flattened Butterfly : Cost-efficient High-Radix Topology

Researchers in Prof. William Dally's laboratory have developed a novel, cost-efficient topology for high-radix networks. This technology uses concentrated high-radix routers and a globally load-balancing routing algorithm to decrease the number of links (or cables) in high-performance interconnection networks such as supercomputer or data centers. The flattened butterfly requires half as many cables as folded-Clos topology with better path diversity than a conventional butterfly.

## Ongoing Research

The inventors continue their research on the flattened butterfly to better understand implementation issues.

## Related Technologies from The Dally Lab:

[Stanford Docket S14-246 "Probabilistic Cache Replacement to Reduce Cache Misses"](#)

[Stanford Docket S12-374 "Power electronics system that harvests excess power from unbalanced photovoltaic modules to boost overall efficiency"](#)

[Stanford Docket S11-305 "Speculative Reservation Protocol"](#)

[Stanford Docket S12-138 "High-Radix Interprocessor Communications System and Method"](#)

[Stanford Docket S07-359 "Technology-Driven, Highly-Scalable Dragonfly Topology"](#)

## Applications

- **High performance interconnection networks**, such as:
  - multiprocessor computer systems
  - data communication networks

## Advantages

- **Low cost** - reduces the number of cables by approximately 2x, compared to a high-radix folded-Clos topology (therefore the folded butterfly is roughly half the cost of a comparable performance Clos network)
- **High performance** - can lead to an order of magnitude increase in performance compared to a conventional butterfly

## Publications

- John Kim, William Dally, Dennis Abts ["Flattened Butterfly : A Cost-efficient Topology for High-Radix Networks"](#) Proceedings of the 34th International Symposium on Computer Architecture (ISCA-34) San Diego, California, June 2007.
- U.S. Patent Application: ["Flattened Butterfly Processor Interconnect Network"](#) (Publication No. 20090106529)

## Patents

- Published Application: [20090106529](#)
- Issued: [8,285,789 \(USA\)](#)

## Innovators

- John Kim
- William Dally
- Dennis Abts

## Licensing Contact

**Mona Wan**

Senior Associate Director, Life Science

[Email](#)