

## CLAIMS

1. A system for using free-space optics to interconnect a plurality of computing nodes, comprising:
  - a plurality of node optical transceivers that are electrically coupled to at least some of the plurality of computing nodes;
  - a router that is configured to communicate with the plurality of computing nodes via free-space optical communications;
  - a plurality of router optical transceivers that are coupled to the router, wherein the plurality of router optical transceivers are distinct from the plurality of node optical transceivers, wherein optical transmissions between the plurality of router optical transceivers and the plurality of node optical transceivers enable the free-space optical communications between the router and the plurality of computing nodes;
  - a plurality of light sources, wherein the plurality of light sources comprise at least one distinct light source for each node optical transceiver among the plurality of node optical transceivers and for each router optical transceiver among the plurality of router optical transceivers; and
  - a plurality of photodetectors, wherein the plurality of photodetectors comprise at least one distinct photodetector for each node optical transceiver among the plurality of node optical transceivers and for each router optical transceiver among the plurality of router optical transceivers.
2. The system of claim 1, wherein:
  - the plurality of node optical transceivers, the plurality of router optical transceivers, and the router interconnect the plurality of computing nodes to form a network fabric; and
  - the plurality of computing nodes are accessible to one another via the network fabric.
3. The system of claim 2, wherein:
  - the plurality of computing nodes comprise a plurality of processing nodes and a plurality of memory nodes;
  - the plurality of processing nodes are not electrically coupled to all of the plurality of memory nodes; and
  - all of the plurality of memory nodes are accessible to all of the plurality of processing nodes via the network fabric.
4. The system of any preceding claim, wherein:

the plurality of node optical transceivers are not electrically coupled to the router;  
and

the plurality of router optical transceivers are not electrically coupled to the plurality of computing nodes.

5. The system of any preceding claim, wherein:

a first computing node is electrically coupled to a first node optical transceiver;

a first router optical transceiver is optically coupled to the first node optical transceiver;

a second computing node is electrically coupled to a second node optical transceiver;

a second router optical transceiver is optically coupled to the second node optical transceiver;

the first router optical transceiver is configured to receive a first modulated light beam from the first node optical transceiver and demodulate the first modulated light beam to extract data;

the router is configured to route the data to the second router optical transceiver;

and

the second router optical transceiver is configured to transmit a second modulated light beam to the second node optical transceiver, the second modulated light beam comprising the data.

6. The system of any preceding claim, wherein the router comprises at least one of:

an electrical crossbar switch that performs routing operations;

a microelectromechanical systems (MEMS) device that performs the routing operations; and

a prism that performs the routing operations.

7. A system for using free-space optics to interconnect a plurality of computing nodes that are located within an enclosure, comprising:

a router that is configured to route free-space optical communications among the plurality of computing nodes;

a plurality of processing nodes in a first zone of the enclosure;

a plurality of optical modules that are electrically coupled to at least some of the plurality of computing nodes;

a plurality of memory nodes in a second zone of the enclosure, wherein each memory node among the plurality of memory nodes is electrically coupled to at least one

processing node among the plurality of processing nodes;

a plurality of optical transceivers that are coupled to the router, wherein the plurality of optical transceivers facilitate free-space optical communications with the plurality of optical modules, and wherein each optical module among the plurality of optical modules has a corresponding optical transceiver that is optically coupled to the optical module; and

at least one light source that is positioned outside of the first zone of the enclosure and that is configured to transmit light beams toward the plurality of optical modules.

8. The system of claim 7, wherein a first temperature of the first zone of the enclosure is lower than a second temperature of the second zone of the enclosure.

9. The system of claim 7, wherein the plurality of optical modules are located in the first zone of the enclosure.

10. The system of claim 7, wherein the plurality of optical modules are located in a third zone of the enclosure.

11. The system of claim 10, wherein:

a first temperature of the first zone of the enclosure is lower than a second temperature of the second zone of the enclosure; and

the second temperature is lower than a third temperature of the third zone of the enclosure.

12. The system of any of claims 7 through 11, wherein:

the plurality of optical modules, the plurality of optical transceivers, and the router interconnect the plurality of computing nodes to form a network fabric; and

the plurality of computing nodes are accessible to one another via the network fabric.

13. The system of claim 12, wherein:

the plurality of processing nodes are not electrically coupled to all of the plurality of memory nodes; and

all of the plurality of memory nodes are accessible to all of the plurality of processing nodes via the network fabric.

14. The system of any of claims 7 through 13, wherein:

each optical module among the plurality of optical modules comprises a modulator and an optics system;

the modulator within a particular optical module is configured to modulate a light beam received from the at least one light source to produce a modulated light beam; and

the optics system within the particular optical module is configured to direct the modulated light beam toward an optical transceiver among the plurality of optical transceivers.

15. The system of any of claims 7 through 14, wherein:
- a first computing node is electrically coupled to a first optical module;
  - a first optical transceiver is optically coupled to the first optical module;
  - a second computing node is electrically coupled to a second optical module;
  - a second optical transceiver is optically coupled to the second optical module;
  - the first optical transceiver is configured to receive a first modulated light beam from the first optical module and demodulate the first modulated light beam to extract data;
  - the router is configured to route the data to the second optical transceiver; and
  - the second optical transceiver is configured to transmit a second modulated light beam to the second optical module, the second modulated light beam comprising the data.