

CLAIMS:

1. A cooling system comprising:

- a ceiling plenum formed between a first ceiling and a second ceiling of a building;
 - a containment assembly disposed above at least one hot aisle formed by a plurality of rows of a plurality of server racks and extending through an aperture in the first ceiling, the containment assembly configured to direct fluid from the hot aisle into the ceiling plenum;
 - a fluid velocity sensor configured to measure velocity of fluid flowing in the hot aisle or the containment assembly;
 - a temperature sensor configured to measure the temperature of the fluid flowing in the hot aisle or the containment assembly;
 - a first row of a plurality of fan and heat exchanger assemblies and a second row of a plurality of fan and heat exchanger assemblies disposed above the first row of the plurality of fan and heat exchanger assemblies, each fan and heat exchanger assembly of the first and second rows including a fan and a heat exchanger configured to be cooled by a liquid; and
 - a controller configured to adjust a speed of the fans of the fan and heat exchanger assemblies based on the measured temperature and velocity,
- wherein the fans of the fan and heat exchanger assemblies of both the first row and the second row cause fluid to flow from the ceiling plenum, through the heat exchangers of the fan and heat exchanger assemblies, and to the plurality of server racks.

2. The cooling system of claim 1, wherein the velocity sensor and the temperature sensor is implemented by an anemometer.

3. The cooling system of claim 1, further comprising a redundant anemometer.

4. The cooling system of claim 1, wherein the at least one fan and heat exchanger assembly is disposed inside an outdoor enclosure outside of the building and adjacent to a wall of the building, and

wherein the at least one fan causes fluid to flow through an aperture in the wall to the plurality of server racks.

5. The cooling system of claim 1, further comprising:

- a floor plenum formed between a floor and a slab of the building; and

an air duct fluidly coupled between the ceiling plenum and the floor plenum,
wherein the at least one fan and heat exchanger assembly is disposed within the air duct and is configured to cause air to flow through the air duct to the floor plenum and through apertures in the floor to the plurality of server racks.

6. The cooling system of claim 1, further comprising an interior wall disposed within the building between the plurality of server racks and the at least one fan and heat exchanger assembly and extending from a floor of the building so as to connect with the first ceiling and form an interior wall aperture between the second ceiling and a top portion of the interior wall.

7. The cooling system of claim 6, wherein a plurality of heat exchangers are disposed between the interior wall and a plurality of fans, and the plurality of fans are configured to cause air to flow from the plurality of server racks, through the interior wall aperture, to the ceiling plenum, and through the containment assembly.

8. The cooling system of claim 6, wherein a plurality of fans are disposed between the interior wall and a plurality of heat exchangers, and the plurality of fans are configured to cause air to flow from the ceiling plenum, through the interior wall aperture, and to the plurality of server racks via the fan and heat exchanger assemblies.

9. The cooling system of claim 1, wherein the at least one fan and heat exchanger assembly includes a fan and heat exchanger assembly enclosure.

10. A cooling system comprising:

- a first containment assembly disposed within a building and disposed adjacent to at least one hot aisle formed by a plurality of rows of a plurality of server racks;

- a fluid velocity sensor configured to measure velocity of fluid flowing in the first containment assembly;

- a temperature sensor configured to measure the temperature of the fluid flowing in the first containment assembly;

- a first row of a plurality of fan and heat exchanger assemblies disposed outside of the building; and

a second row of a plurality of fan and heat exchanger assemblies disposed outside of the building and disposed above the first row of the plurality of fan and heat exchanger assemblies each fan and heat exchanger assembly of the first and second rows including a fan and a heat exchanger configured to be cooled by a liquid; and

a controller configured to adjust a speed of a plurality of fans of the first and second rows of the plurality of fan and heat exchanger assemblies based on the measured temperature and velocity,

wherein the fans of the plurality of fan and heat exchanger assemblies of both the first row and the second row cause air to flow from the hot aisle, through the first containment assembly, through the heat exchangers of the plurality of fan and heat exchanger assemblies, and to the plurality of server racks.

11. The cooling system of claim 10, wherein the first containment assembly is disposed between a side of the hot aisle and at least one aperture in an exterior wall of the building, and

wherein the first and second rows of the plurality of fan and heat exchanger assemblies are in fluid communication with the first containment assembly via the at least one aperture in the exterior wall.

12. The cooling system of claim 10, wherein the first containment assembly is disposed above the hot aisle.

13. The cooling system of claim 12, further comprising a second containment assembly disposed above the first containment assembly.

14. The cooling system of claim 10, further comprising a fan and heat exchanger enclosure housing the plurality of fan and heat exchanger assemblies.

15. A cooling system comprising:

a first containment assembly disposed within a building and disposed adjacent to at least one hot aisle formed by a plurality of rows of a plurality of server racks;

a second containment assembly disposed above and in fluid communication with the first containment assembly;

a fluid velocity sensor configured to measure velocity of fluid flowing in the first containment assembly;

a temperature sensor configured to measure the temperature of the fluid flowing in the first containment assembly;

first and second rows of a plurality of fan and heat exchanger assemblies disposed within the building at a height above the height of the plurality of server racks, the fan and heat exchanger assemblies being coupled to and in fluid communication with the second containment assembly; and

a controller configured to adjust a speed of a plurality of fans of the first and second rows of the plurality of fan and heat exchanger assemblies based on the measured temperature and velocity,

wherein a plurality of fans of the plurality of fan and heat exchanger assemblies cause air to flow from the hot aisle, through the first containment assembly and the second containment assembly, through a plurality of heat exchangers of the plurality of fan and heat exchanger assemblies, and to the plurality of server racks.

16. A method of cooling a plurality of server racks, the method comprising:

sensing, by a hot-wire anemometer disposed within a containment assembly adjacent to at least one hot aisle defined between a plurality of rows of a plurality of server racks, a fluid temperature and a fluid velocity of fluid flowing in the containment assembly;

if the fluid temperature is greater than a predetermined fluid temperature, increasing, by a predetermined speed, a speed of at least one fan circulating fluid through the plurality of server rack, the hot aisle, and a heat exchanger;

if the fluid temperature is not greater than the predetermined fluid temperature, determining whether the fluid velocity is greater than a predetermined velocity;

if the fluid velocity is greater than the predetermined velocity, decreasing the speed of the at least one fan by another predetermined speed; and

if the fluid temperature is not greater than the predetermined fluid temperature and the fluid velocity is not greater than the predetermined velocity, maintaining the speed of the at least one fan.