WHAT IS CLAIMED IS:

1. A data center cooling system, comprising:

a floor structure defining a below-floor warm-air plenum and an above-floor cool air plenum;

a plurality of above-floor computer assemblies arranged to exhaust warmed air into the warm-air plenum; and

one or more fan-coil arrangements to draw air from the warm-air plenum, cool the air, and provide the air to the cool air plenum.

2. The system of claim 1, further comprising a vertical plenum fluidly connecting the computer assemblies to the warm-air plenum through an opening defined in the floor structure.

3. The system of claim 1, wherein the one or more fan-coil arrangements include one or more packaged fan-coil units.

4. The system of claim 1, wherein the warm-air plenum and the cool-air plenum are sized in volume to substantially eliminate temperature hot spots created by failures of the fan-coil arrangements.

5. The system of claim 1, wherein the warm-air plenum defines a volume that is at least 20 percent as large as a volume defined by the cool-air plenum.

6. The system of claim 1, wherein the plurality of computer assemblies comprise a plurality of vertical racks arranged in a row exhausting warmed

air into a vertical plenum that is in fluid communication with the below-floor warm air plenum.

7. The system of claim 1, further comprising air circulation fans adjacent to the computer assemblies and fan controllers configured to maintain a set exit air temperature from the computer assemblies.

8. The system of claim 1, further comprising air circulation fans adjacent to the computer assemblies and fan controllers configured to maintain a maximum safe operating temperature for components on the computer assemblies.

9. The system of claim 1, further comprising a fan-coil assembly controller configured to maintain a set pressure difference between the warm-air plenum and the cool-air plenum.

10. The system of claim 9, wherein the set pressure difference is approximately zero.

11. A method of operating a cooling system for a data center, comprising:

circulating air across a plurality of computers to remove heat accumulated by the computers;

capturing the air in an above-floor warm air plenum and directing the air downward into a below-floor warm air plenum; and

capturing the warmed air, cooling the warmed air, and providing the cooled air to an above-floor workspace.

12. The method of claim 11, further comprising continuously circulating the air across the computers, into the below-floor warm air plenum, through the circulation and cooling equipment, and back into the workspace.

13. The method of claim 11, wherein providing the cooled air comprises circulating the warmed air through an under-floor cooling coil using an under-floor fan.

14. The method of claim 11, wherein circulating air across the plurality of computers comprises drawing the air across the computers using fans located adjacent the computers.

15. The method of claim 11, further comprising controlling the fans located adjacent the computers to maintain set exit air temperatures from the computers.

16. The method o claim 11, wherein the below-floor warm air plenum is at least 20 percent the volume of the above-floor cold –air plenum.

17. A data center cooling system, comprising:

a data center workspace providing cooling air to a large plurality of computer assemblies;

a warm-air plenum receiving air circulated past and warmed by the computer assemblies; and

a data center floor defining, at least in part, a barrier between the data center workspace and the warm-air plenum.

18. The system of claim 17, further comprising a plurality of air circulation fans in the warm-air plenum and a plurality of cooling coils associated with the air circulation fans located at an edge of the warm-air plenum.

19. The system of claim 18, wherein the air circulation fans are configured to draw air out of the warm-air plenum and supply the air, after cooling by the cooling coils, to the workspace.

20. The system of claim 17, wherein the datacenter workspace is contained in one or more modular computing frames containing the computer assemblies and the warm-air plenum is contained in one or more modular mechanical frames configured to be joined to the one or more first modular frame.

21. The system of claim 20, wherein the system includes a first modular workspace frame stacked on top of a second modular workspace frame, which is in turn stacked on top of a mechanical frame.

CLAIMS

1. A data center cooling system, comprising:

a floor structure defining a below-floor warm-air plenum and an above-floor cool air plenum;

a plurality of above-floor computer assemblies arranged to exhaust warmed air into the warm-air plenum;

one or more fan-coil arrangements to circulate air from the warm-air plenum, cool the air, and provide the air to the cool air plenum;

a vertical plenum fluidly connecting the computer assemblies to the warm-air plenum through an opening defined in the floor structure; and

one or more assist fans configured to circulate warmed air downward through the vertical plenum towards the one or more fan-coil arrangements,

wherein each of the plurality of above-floor computer assemblies is adjacent to a human-occupiable walkway that is part of the above-floor cool air plenum within a data center building and comprises a rack having a cabinet that at least partially houses a plurality of heat generating devices that are accessible from the human-occupiable walkway,

a first portion of the plurality of above-floor computer assemblies is enclosed within a first modular frame that comprises the floor structure, and

the one or more fan-coil arrangements is enclosed within a second modular frame that is separate from and attached to the first modular frame, and arranged so that warmed air is circulated by the one or more fan coil arrangements from a portion of the above-floor plenum at least partially enclosed within the first modular frames to the fan-coil arrangements and to the walkway, the first and second modular frames having substantially similar lengths and widths.

2. The system of claim 1, wherein the one or more fan-coil arrangements include one or more packaged fan-coil units.

3. The system of claim 1, wherein the warm-air plenum and the cool-air plenum are sized in volume to substantially eliminate temperature hot spots created by failures of the fan-coil arrangements.

4. The system of claim 1, wherein the warm-air plenum defines a volume that is at least 20 percent as large as a volume defined by the cool-air plenum.

5. The system of claim 1, wherein the plurality of computer assemblies comprise a plurality of vertical racks arranged in a row exhausting warmed air into a vertical plenum that is in fluid communication with the below-floor warm air plenum.

6. The system of claim 1, further comprising:

air circulation fans adjacent to the computer assemblies and configured to draw cool air across the heat generating devices; and

fan controllers configured to maintain a set exit air temperature from the computer assemblies.

7. The system of claim 1, further comprising air circulation fans adjacent to the computer assemblies and fan controllers configured to maintain a maximum safe operating temperature for components on the computer assemblies.

8. The system of claim 1, further comprising a fan-coil assembly controller configured to maintain a set pressure difference between the warm-air plenum and the cool-air plenum.

9. The system of claim 8, wherein the set pressure difference is approximately zero.

10. The system of claim 1, wherein the one or more fan-coil arrangements comprise a plurality of fan-coil arrangements, and wherein each of the plurality of fan-coil arrangements is in fluid communication with each of the plurality of above-floor computer assemblies.

11. The system of claim 10, further comprising a plurality of cooling fluid supply conduits coupled to the plurality of fan-coil arrangements, wherein the plurality of cooling fluid supply conduits are arranged orthogonal to a plurality of rows of the plurality of above-floor computer assemblies.

12. The system of claim 11, wherein the plurality of cooling fluid supply conduits comprise:

a first cooling fluid supply conduit fluidly coupled between a fluid cooling source and a first portion of the plurality of fan-coil arrangements; and

a second cooling fluid supply conduit fluidly coupled between the fluid cooling source and a second portion of the plurality of fan-coil arrangements,

wherein the first portion of the plurality of fan-coil arrangements provides air to the cool air plenum adjacent a first portion of above-floor computer assemblies in a particular row of the plurality of rows, and the second portion of the plurality of fan-coil arrangements provides air to the cool air plenum adjacent a second portion of above-floor computer assemblies in the particular row of the plurality of rows.

13. The system of claim 1, wherein there is a greater quantity of cooling coils than quantity of fans in the plurality of fan-coil arrangements.

14. The system of claim 1, wherein a front side of the rack is open to the human-occupiable walkway.

15. The system of claim 1, wherein the one or more fan-coil arrangements are arranged underneath the floor structure and configured to circulate cool air from the warm-air plenum to the above-floor cool air plenum enclosed within the first and second modular frames.

16. The system of claim 15, wherein the one or more fan-coil arrangements are configured to circulate cool air from the warm-air plenum to the above-floor cool air plenum enclosed within the first modular frame.

17. The system of claim 1, wherein the one or more fan-coil arrangements are positioned in a draw-through arrangement to draw air from the warm-air plenum, cool the air, and provide the air to the cool air plenum.

18. A data center cooling system, comprising:

a human-occupiable data center workspace providing cooling air to a plurality of computer assemblies;

a warm-air plenum receiving air circulated past and warmed by the computer assemblies;

a data center floor defining, at least in part, a barrier between the data center workspace and the warm-air plenum;

a vertical plenum fluidly connecting the computer assemblies to the warm-air plenum through an opening defined in the data center floor; and

one or more assist fans configured to circulate warmed air downward through the vertical plenum towards one or more air conditioning modules that are at least partially located in the warm-air plenum,

wherein the human-occupiable data center workspace defines a plenum above the data center floor and external to the plurality of computer assemblies that captures the cooling air from the one or more air conditioning modules,

the human-occupiable data center workspace is contained in one or more modular computing frames that contain the computer assemblies, and the warm-air plenum is contained in one or more modular mechanical frames separate from the one or more modular computing frames and configured to be attached to the one or more modular computing frames, at least one of the one or more modular computing frames having a length and width substantially identical to a length and width of an attached modular mechanical frame.

19. The system of claim 18, wherein the one or more air conditioning modules comprise a plurality of air circulation fans in the warm-air plenum and a plurality of cooling coils associated with the air circulation fans located at an edge of the warm-air plenum.

20. The system of claim 19, wherein the air circulation fans are configured to draw air out of the warm-air plenum and supply the air, after cooling by the cooling coils, to the human-occupiable data center workspace.

21. The system of claim 18, wherein the warm-air plenum comprises a human-occupiable mechanical workspace.

22. The system of claim 18, further comprising air circulation fans adjacent to the computer assemblies and configured to draw cool air across the computer assemblies.

23. A method of operating a cooling system for a data center, comprising:

circulating cool air from a warm air plenum using fans located in a first modular frame that at least partially defines the warm-air plenum, to a first above-floor cool air plenum that comprises a first human-occupiable workspace in a second modular frame;

circulating cool air to a second above-floor cool air plenum that comprises a second human-occupiable workspace in a third modular frame stacked on top of the second modular frame;

circulating the cool air from the first and second human-occupiable workspaces through a plurality of above-floor computer assemblies adjacent the workspaces and across a plurality of computers mounted in the above-floor computer assemblies to remove heat created by the computers by drawing the cool air across the computers using fans located adjacent the computers;

capturing air from the above-floor computer assemblies that is heated by the computers and directing the heated air into the warm air plenum through at least one fenestration in the second modular frame and the third modular frame; and

cooling the heated air with one or more coil arrangements in the second modular frame.

24. The method of claim 23, wherein the cool air is continuously circulated from the first and second human-occupiable workspaces through the plurality of above-floor computer assemblies within the workspaces and across the plurality of computers mounted in the above-floor computer assemblies to remove heat accumulated by the computers.

25. The method of claim 23, wherein the first modular frame is located below a floor of the second modular frame.

26. The method of claim 23, further comprising controlling the fans located adjacent the computers to maintain set exit air temperatures from the computers.

27. The method of claim 23, wherein the warm air plenum is at least 20 percent the volume of the above-floor cold-air plenum.