

CLAIMS

1. A modular data center comprising:

one or more data modules;

a power module connected to the one or more data modules, the power module comprising electronics equipment for conditioning and distributing power to the one or more data modules,

wherein each module of the one or more data modules and the power module comprises:

an enclosure defining an internal space;

a floor within the enclosure separating the internal space into an above floor space and a sub-floor space;

a controller disposed in a first module wherein the first module comprises a data module;

one or more sensors disposed in the first module in communication with the controller, wherein the one or more signals are configured to receive signals associated with the one or more sensors of the first module; and

a data center control system in communication with one of the controller and the one or more sensors, the data center control system configured to collect data associated with the data center.

2. The modular data center of claim 1, wherein the enclosures of the one or more data modules and the power module have substantially the same dimensions.

3. The modular data center of claim 1, further comprising:

a plurality of bays in the sub-floor space of the first module, wherein at least a first bay of the plurality of bays is configured to contain a field-replaceable environmental management component; and

a heat exchanger in a second bay of the plurality of bays of the first module, the heat exchanger configured to remove heat from air within the enclosure of the first data module.

4. The modular data center of claim 1, further comprising:

a structure disposed in the above-floor space of the first module of the one or more data modules separating the above-floor space into a first aisle and a second aisle; and

a heat exchanger disposed in the sub-floor space of the first module configured to remove heat from air flowing from the first aisle.

5. The modular data center of claim 4, wherein the structure disposed in the above-floor space comprises computing equipment.
6. The modular data center of claim 1, wherein the controller adjusts an environmental parameter of the first module based on one or more signals associated with the one or more sensors.
7. The modular data center of claim 6, wherein the environmental parameter is one of a temperature within the enclosure, a pressure within the enclosure, a humidity within the enclosure, or an airflow speed within the enclosure.
8. The modular data center of claim 6, wherein the one or more sensors are one of a temperature sensor, pressure sensor, humidity sensor, fan speed sensor, or valve position sensor.
9. The modular data center of claim 1, wherein the data center control system is configured to receive signals associated with the one or more sensors of the first module.
10. The modular data center of claim 1, wherein the data center control system is an environmental management component configured to control the environmental conditions of the first module.
11. The modular data center of claim 10, further comprising a plurality of bays in the subfloor space, wherein at least a first bay of the plurality of bays is configured to contain the environmental management component.
12. The modular data center of claim 1 further comprising a network operations center in at least one data module of the one or more data modules.
13. A method of deploying a data center:
supplying one or more data modules;

connecting a network module to the one or more data modules, the network module comprising equipment for facilitating data communications by the one or more data modules;

connecting a power module to the one or more data modules and the network module, the power module comprising electronics equipment for conditioning and distributing power to at least one of the one or more data modules and the network module;

wherein each module of the one or more data modules, the network module, and the power module comprises:

an enclosure defining an internal space;

a floor within the enclosure separating the internal space into an above floor space and a sub-floor space; and

a plurality of bays in the subfloor space, wherein at least a first bay of the plurality of bays is configured to contain a field-replaceable environmental management component.

14. The method of claim 13, wherein the enclosures of the one or more data modules, the network module, and the power module have substantially the same dimensions.
15. The method of claim 13, further comprising: disposing a heat exchanger in a second bay of the plurality of bays of a first data module of the one or more data modules, the heat exchanger configured to remove heat from air within the enclosure of the first data module.
16. The method of claim 13, further comprising:
17. disposing a structure in the above-floor space of a first data module of the one or more data modules, separating the above-floor space into a first aisle and a second aisle; and disposing a heat exchanger in the sub-floor space of the first data module to remove heat from air flowing from the first aisle.
18. The method of claim 13, wherein a first module of the one or more data modules, the network module, and the power module further comprises: a controller disposed in the first module and in communication with one or more sensors disposed in the first module, wherein the controller adjusts an environmental parameter of the first module based on one or more signals associated with the one or more sensors.

19. The method of claim 17, wherein the environmental parameter is one of a temperature within the enclosure, a pressure within the enclosure, a humidity within the enclosure, or an airflow speed within the enclosure.
20. The method of claim 17, wherein the one or more sensors are one of a temperature sensor, pressure sensor, humidity sensor, fan speed sensor, or valve position sensor.
21. The method of claim 13, further comprising: providing a data center control system, wherein a first module of the one or more data modules, the network module, and the power module further comprises: one or more sensors, wherein the data center control system is configured to receive signals associated with the one or more sensors of the first module.
22. The method of claim 13, wherein each module of the one or more data modules, the network module, and the power module further comprises one or more sensors, wherein a data center control system is configured to receive signals associated with the one or more sensors.
23. The method of claim 13, further comprising disposing a humidifier in a second bay of the plurality of bays in a first data module of the one or more data modules.
24. The method of claim 13, further comprising disposing a network operations center in at least one data module of the one or more data modules.
25. A method of provisioning a data center:
 - providing one or more data modules based on a computing capacity parameter;
 - connecting one or more network modules to the one or more data modules based on the computing capacity parameter and a redundancy parameter, the one or more network modules comprising equipment for facilitating data communications by the data modules;
 - connecting one or more power modules to the one or more data modules and the one or more network modules based on the computing capacity parameter and the redundancy parameter, the one or more power modules comprising electronics equipment for conditioning and distributing power to one of the one or more data modules or the one or more network modules, wherein each module of the one or more data modules, the one or more network modules, and the one or more power modules comprises:

an enclosure defining an internal space;

a floor within the enclosure separating the internal space into an above-floor space and a sub-floor space; and

a plurality of bays in the subfloor space, each bay of the plurality of bays configured to contain a field-replaceable environmental management component.

26. The method of claim 24, wherein the computing capacity parameter is one of a power capacity, a processing capacity, or a storage capacity.
27. The method of claim 24, wherein the enclosures of the one or more data modules, the one or more network modules, and the one or more power modules have substantially the same dimensions.
28. The method of claim 24, further comprising: disposing one or more heat exchangers in a first bay of the plurality of bays of the one or more data modules based on the computing capacity parameter and a redundancy parameter.
29. The modular data center of claim 1, wherein the data center control system determines, based upon data received from the sensors, an environmental condition of the first module.
30. The modular data center of claim 1, wherein the controller determines, based upon data received from the sensors, an environmental condition of the first module.
31. The modular data center of claim 1, wherein the environmental condition comprises a differential pressure between the hot aisle and the cold aisle and wherein the controller modulates the speed of one or more the fans of an air handler to maintain a desired pressure differential between the hot and cold aisles.
32. The modular data center of claim 1, wherein the environmental condition comprises a temperature within the first module and wherein the controller determines that the temperature exceeds a threshold.
33. The modular data center of claim 30, wherein, in response to determining that the temperature exceeds the threshold, the controller increases the speed of the fans in an air handler to lower the temperature.

34. The modular data center of claim 30, further comprising the controller opening a chilled fluid supply valve of a chilled fluid supply pipe to increase a flow of chilled fluid to an air handler to lower the temperature.
35. The modular data center of claim 1, further comprising a network module connected to the one or more data modules, the network module comprising equipment for facilitating data communications by the one or more data modules.

CLAIMS

Listing of the claims

1. A modular data center comprising:
 - one or more data modules;
 - a power module connected to the one or more data modules, the power module comprising electronics equipment for conditioning and distributing power to the one or more data modules,
 - wherein each module of the one or more data modules and the power module comprises:
 - an enclosure defining an internal space;
 - a floor within the enclosure separating the internal space into an above floor space and a sub-floor space;
 - a controller disposed in a first module wherein the first module comprises a data module;
 - one or more sensors disposed in the first module in communication with the controller, wherein the controller is configured to receive signals associated with the one or more sensors of the first module; and
 - a data center control system in communication with one of the controller and the one or more sensors, the data center control system configured to collect data associated with the data center.
2. The modular data center of claim 1, wherein the enclosures of the one or more data modules and the power module have substantially the same dimensions.
3. The modular data center of claim 1, further comprising:
 - a plurality of bays in the sub-floor space of the first module, wherein at least a first bay of the plurality of bays is configured to contain a field-replaceable environmental management component; and

a heat exchanger in a second bay of the plurality of bays of the first module, the heat exchanger configured to remove heat from air within the enclosure of the first data module.

4. The modular data center of claim 1, further comprising:

a structure disposed in the above-floor space of the first module of the one or more data modules separating the above-floor space into a first aisle and a second aisle; and

a heat exchanger disposed in the sub-floor space of the first module configured to remove heat from air flowing from the first aisle.

5. The modular data center of claim 4, wherein the structure disposed in the above-floor space comprises computing equipment.

6. The modular data center of claim 1, wherein the controller adjusts an environmental parameter of the first module based on one or more signals associated with the one or more sensors.

7. The modular data center of claim 6, wherein the environmental parameter is one of a temperature within the enclosure, a pressure within the enclosure, a humidity within the enclosure, or an airflow speed within the enclosure.

8. The modular data center of claim 6, wherein the one or more sensors are one of a temperature sensor, pressure sensor, humidity sensor, fan speed sensor, or valve position sensor.

9. The modular data center of claim 1, wherein the data center control system is configured to receive signals associated with the one or more sensors of the first module.

10. The modular data center of claim 1, wherein the data center control system is an environmental management component configured to control the environmental conditions of the first module.

11. The modular data center of claim 10, further comprising a plurality of bays in the subfloor space, wherein at least a first bay of the plurality of bays is configured to contain the environmental management component.

12. The modular data center of claim 1 further comprising a network operations center in at least one data module of the one or more data modules.

13. The modular data center of claim 1, wherein the controller determines, based upon data received from the sensors, an environmental condition of the first module.

14. The modular data center of claim 13, further comprising a structure disposed in the above-floor space of the first module of the one or more of the data modules separating the above-floor space into a first aisle and a second aisle, wherein the environmental condition comprises a differential pressure between the first aisle and the second aisle and wherein the controller modulates the speed of one or more the fans of an air handler to maintain a desired pressure differential between the first and second aisles.

15. The modular data center of claim 13, wherein the environmental condition comprises a temperature within the first module and wherein the controller determines that the temperature exceeds a threshold.

16. The modular data center of claim 15, wherein, in response to determining that the temperature exceeds the threshold, the controller increases the speed of the fans in an air handler to lower the temperature.

17. The modular data center of claim 16, further comprising the controller opening a chilled fluid supply valve of a chilled fluid supply pipe to increase a flow of chilled fluid to an air handler to lower the temperature.

18. The modular data center of claim 1, further comprising a network module connected to the one or more data modules, the network module comprising equipment for facilitating data communications by the one or more data modules.